PULLEY & BELT TRANSMISSION

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PULLEY AND BELT TRANSMISSION

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INTRODUCTION

THE system which employs belting and pulleys is the most common of all systems of power transmission. It is particularly universal for small amounts of power, and is the ultimate means of distribution in mills and factories, except where electric motors are employed, and even then there are frequently found belting and pulleys, used at the beginning and the end of the system for transmission from the prime mover to the dynamo, and from the motor to the machines. Efficiency of transmission, both as regards first cost and loss of power in an electrical system, invariably receives the most careful consideration, while the efficiency of the belting system is almost as generally neglected. The selection of belts and pulleys for machines is left to the "handy man" of the shop, who, from carelessness or ignorance, may make an extravagant and permanently inefficient investment in a new plant, or who, in making extensions to an old one, will use whatever old pulleys and greasy belting that may be lying around, material which would better be consigned to the scrap pile.

Most drives are belt drives.

Many belt drives are bad.

There are two reasons for this: First, one is apt to think of the belt as a simple band that moves one pulley because it is moved by another, without considering that this transmission necessarily involves some loss of power, and that this loss will be governed by the kind of pulleys and belting in use and their arrangement.

Second, those who have charge of making such installation lack reliable data in a convenient form, as to the different kinds of belting and pulleys and their relative merits. The engineering handbooks, as a rule, give only empirical formulæ based upon assumed sets of conditions, which in general are not realized; while the experimental data from which they are derived is generally based upon tests of iron pulleys only, and not applicable to those of wood, paper, or various other materials which have recently been placed upon the market. The theoretical treatment as found in text books is too complex for ready assimilation, and cannot be applied to every-day problems without elaborate computations.

In the following pages will be found the usual theoretical treatment reduced to its simplest possible form, combined with experimental data taken from tests, together with data and tables easily applicable to the practical design of correct belt transmission systems.

The tests referred to were made upon pulleys of various makes and materials in common use, and were conducted at the Sibley College of Engineering, Cornell University.

The following treatise is divided into three main parts:

PART I—VARIOUS KINDS OF BELT DRIVES; THEIR ARRANGEMENT AND MATERIALS USED IN THEIR CONSTRUCTION.

PART II—THEORY OF BELT DRIVING, TESTS AND PRACTICAL FORMULÆ DEVELOPED.

PART III—HORSE-POWER TABLES FOR PULP, WOOD, CAST-IRON AND ROCKWOOD PAPER PULLEYS.

The engineer thoroughly conversant with belt driving in general will spend but little time upon Part I, which to him can only be in the nature of an introduction to Part II. It is hoped that the horse-power tables in Part III will prove of service.

PART I

Various Kinds of Belt Drives; Their Arrangement and Materials Used in Their Construction

BELT DRIVES

Before entering into a discussion of the materials of which belts and pulleys are made, it will be well to first take up something about the theory of belt driving, *i. e.*, requirements for satisfactory running, etc.

The working element in a belt drive is the tractive force or friction between the belt and the pulley. This depends upon the pressure of the belt on the pulley, on the nature of the pulley surface, and, as will be shown later, upon the speed of slip of the belt and the arc of contact. The pressure of the belt upon the pulley is due to the tension in the belt, which is obtained by stretching when it is put on. In order that this tension may be maintained it is necessary that the belt be of an elastic material, and that it be permanently elastic under the maximum tension to which it is subjected in operation. As this tension is considerably below the ultimate strength of the belt, it is this feature that determines the maximum tension allowable. If the tension is too high, the belt will stretch permanently and must be frequently taken up to prevent slipping. If it is too low, the horse-power transmitted is reduced and the maximum efficiency is not obtained. In the transmission of power by belting one side of the belt has necessarily a greater tension than the other. One side is tight, the other is slack. The difference between the tensions of the tight and loose sides is the *effective pull* of the belt, and is equal to the total friction between the belt and the pulley. It will therefore be evident that with a given tension in the belt, the power transmitted depends upon the the friction between the pulley and the belt, and that that combination of belt and pulley is the most effective in which the ratio of friction to belt pressure (the coefficient of friction) is the greatest.

KINDS OF DRIVES

All belt drives may be classified under one of the three following heads:

a. Those in which the weight of the belt alone is enough to produce a driving force sufficient to transmit the power desired.

b. Those in which sufficient driving force is produced by putting an initial tension in the belt, thus using the elastic properties of the belt. This is by far the most common case, although the weight of the belt itself usually helps, as under *a.*

c. Those in which the requisite driving force in the belt is produced by a so-called idler pulley. A modification of this scheme is the use of a tension carriage.

MATERIAL FOR BELT DRIVES

A. BELTING

Belts are to-day made of various materials, such as leather, rubber, canvas, etc.

Leather is by far the most common, and, so far, also the best material for belting. The best quality is obtained from the hides of young bulls; the hides of the older animals and of cows are inferior, being less elastic and uniform. The average hide after being trimmed and worked down flat furnishes a strip of material suitable for belt leather from 3 to 4½ feet long and something less than these figures wide. The average thickness of single belt leather is not far from $\frac{3}{16}$ inch, some hides, however, furnish somewhat heavier, others thinner material.

The best material of the hide is down the middle of the back, although it is the thinnest there. The reason for this is that the leather at that point is of uniform quality as regards its elastic properties, which is not true of the sides. The leather at the sides is less firm and elastic than at the center, and this difference increases as the cuts are made further and further from the center. The same defect appears as the length of the cuts or "laps" increases running up on the neck. So that it is found that belts with "short laps" cut from "centers" stretch uniformly and run true, while belts cut from "sides" or with long laps stretch more on one side than on the other, and therefore run crooked and are less efficient transmitters, as a uniform tension cannot be maintained over their width. The sides should therefore be used for narrow belts only, 8 to 10 inches being the maximum limit, and even this should be decreased for high tensions.

Single leather belts up to three feet wide may be cut from extra heavy hides, provided they are cut equally from each side of the center, but ordinarily the limit of width is reached somewhat sooner than this, and for wider belts it is necessary to use double belts, the width being obtained by combining two or more strips of hide. As a matter of fact, beyond 18 inches wide single belts cease to be very satisfactory, owing to the decided difference in the qualities of the leather at middle and sides of belt.

Short-lap single leather belts cut from *centers* of heavy hides will be found superior to double belts on pulleys of small diameter, on account of their greater flexibility. They will, however, generally have to be made to order, as this grade of hides is usually reserved for use in the more expensive wide double belts.

Double belts can be made much wider than single belts—the bad effect of the irregularity of the leather being overcome by laying up the belt so that the more elastic parts combine with those less elastic; that is, with the sides of the hides over the centers.

In making up the length of the belt each hide furnishes a strip which may be from forty to sixty inches long. Fifty-four inches is a safe figure, and if this is specified a good quality of leather is assured. The ends of the strip are scarfed down for a distance of from six to fifteen inches, depending on the width of the belt. The scarfed ends are lapped over each other and glued together, the joint being allowed to dry under pressure. The joint is sometimes riveted or laced in addition as a further precaution. If the belt is to be exposed to a damp atmosphere riveting or lacing of joints is a necessity. But as a leather belt should never be run in a damp place, because when so run the value of the glued joints is practically nothing, it is questionable if this practice is of any advantage. In the case of double belting, the width of the belt is made up in the same manner. In the case of extremely wide belts, centers only should be used; and the width of one ply should be made of two centers with the joint in the middle, and the width of the other ply of three centers with the joints lying opposite the solid parts of the first ply. Three-ply belts should be made with one ply having two centers; the other two plys having three centers with the joints overlapped. In making double belts, the flesh side of the hide is either shaved down in the high spots to produce a uniform thickness, or the low spots filled with leather strips to equal the thickness of the high spots, both systems having some advocates. It is claimed that the filling system produces a stronger belt as the densest portion of the hide is on the flesh side.

The general opinion seems to be that oak-tanned leather belting is the best. The tensile strength of leather may be taken to be from 3,500 to 6,500 pounds per square inch. The joints made in making up the length of the belt cause this strength to fall off from 20 to 30 per cent., and it should be remembered that a glued or laced joint is not as strong as one glued and riveted.

The limit of real strength of a belt, however, is that of the joint connecting the two ends, just as a chain is no stronger than its weakest link. This is made either by lacing with strips of leather, sewing with fine wire, by belt hooks, or other fastenings—generally patented.

Endless belts are made by scarfing the ends, lapping them and joining with glue. Such a joint is ideal, and if well made it has nearly the full strength of the rest of the belt, and is almost as flexible. It should always be allowed ample time to dry under uniform pressure. Wide, high speed belts should always be made endless, and there is little excuse, except the delay of waiting to dry, for not making small ones in this way. They are certain to give better service in the long run. Of the other methods, lacing is the most common and best, as it is convenient and the joint is flexible. To obtain the greatest strength in a laced joint the holes should be small and the lace as large as can be drawn through them.

It is a good rule to stretch all belts for two or three days before using them. The tension applied should be two or three times the maximum tension likely to be used during operation. By this method a great deal of the stretch is taken out of the belt, and the troublesome "taking up" of the belts is rendered much less frequent. This stretching before use is of course more important for large than for small belts. In this country it is general practice to run the hair side of the belt next the pulley. In Europe the opposite practice is followed. As the hair side is softer and smoother and thus makes better contact with the pulley, it seems reasonable to suppose that it will transmit the greater power. Experimental data on this subject is meagre. Some tests made at the Massachusetts Institute of Technology show in most cases a slight increase in the friction of the hair side over that of the flesh side, while in a few instances the flesh side shows better results.

Belts of other materials, such as rubber, hemp, canvas or cotton, are sometimes used instead of leather. The reasons for this are: The tendency for leather belting to change its length with varying humidity of surrounding atmosphere; the strong influence of atmospheric conditions in general upon the life of leather belting, and the necessity of building up a belt from comparatively small unit material. It cannot be said that any of the substitute materials above mentioned have replaced leather to any great extent. It should be kept in mind that the elastic properties of the material, and not the tensile strength, is the important thing.

Cotton belting, according to Unwin, is made of from four to ten thicknesses of cotton duck stitched together. Four-ply belting is from 1½ to 6 inches wide; six-ply, 3 to 12 inches; eight-ply, 6 to 30 inches, and ten-ply, 12 to 60 inches.

Ordinarily four-ply cotton belting is taken as the equivalent of single leather, and eight-ply equal to double leather belting.

Rubber belting is frequently used in extremely damp places or upon machinery where the belting is constantly exposed to the splashing of water, as is the case in certain classes of paper machinery.

In the case of high speed operation, there are two things which decrease the effective friction, or adhesive power, between the belt and pulley face. The first of these is the effect of centrifugal force, which tends to throw the belt away from the pulley as it moves around with it. The second is supposed to be a layer of air which is drawn between belt and pulley face, owing to the high speed. The effect of the centrifugal force cannot be readily overcome, it being directly dependent upon the speed and the weight of the belt. Proof of the second effect seems to have been obtained in a number of cases where it was demonstrated that belts and pulleys gave better tractive results when perforated or grooved. The gain that can in this way be obtained, however, is not constant throughout the range of tensions on a given belt, the good effect being relatively greater when the belt is slack than when it is tight. Care must also be taken to see that the effective surface of either belt or pulley is not cut down so far as to offset the gain by perforating.

Where the distance between axes of shafts is short, for high velocity ratios or for damp places, chain and link belts give excellent service. This kind of belt is more flexible and is easily shortened or lengthened by the taking out or insertion of extra links, but its use is confined to comparatively low linear velocities on account of difficulties in proper lubrication at high speeds.

B. PULLEYS

The most common material for pulleys is cast-iron. This is ideal in respect to cost of manufacture, as it can be conveniently cast in any shape desired. It is, however, a heavy material, and except in such cases as engine fly-wheels where heavy weight is required, considerations of cheap product have led to the reduction of cross sections to such a point that shrinkage strains, due to irregular cooling, are liable to greatly reduce the useful strength of the material. Correct design and careful handling in the foundry may largely overcome the trouble from this source, but as such care tends to the reduction of output, the extent to which its benefits are realized in the commercial product is doubtful. Split pulleys are less liable to shrinkage strains, and large sizes should always be made with their hubs sectionalized, to partly relieve the strain in the rim. The irregularities of moulding result in pulleys that are out of balance, due to the occurrence of greater thickness in some parts. Such pulleys are usually balanced by one or two more or less heavy weights attached to the inside of the rim. These weights are necessarily placed at the lightest part of the rim, and their centrifugal force concentrated at a point on the rim that is already weaker than normal, is an element of weakness and danger that is seldom appreciated. Such pulleys will frequently burst at speeds but little greater than one-half the theoretical bursting speed of a pulley with uniform cross sections of rim.

Efforts to overcome the great weight of cast-iron pulleys have led to the construction of pulleys made wholly or in part of sheet steel. These are sometimes made of a steel rim riveted to a central spider consisting of hub and spokes of cast iron; or sometimes the spokes are of steel cast into a central hub of iron. These pulleys are usually split, the two halves being bolted together at the hub and rim. As far as light weight is concerned, these pulleys are certainly a success, but the same cannot be said of their wearing qualities, as the fastenings are liable to work loose and the light rims are frequently deformed under the belt and the centrifugal tensions due to heavy load and high speeds.

Many efforts have been made to increase the friction or tractive effort between the leather belt and the iron pulley, by the use of pulley coverings of various materials, having a more yielding and fibrous surface. Such coverings may answer the purpose for a short time but they are not durable and have to be frequently renewed.

Pulleys of wood, paper and pulp have been devised mainly of patented constructions, all of which are claimed by their manufacturers to possess greater adhesive powers and to transmit more power than the others. Assertions by the makers in this respect have been many, and their explanations of advantages have been plausible, but actual data and tests under running conditions have not been obtainable to substantiate these claims. It was with the object of supplying such experimental data, from an unbiased source, that the tests described in the following pages were undertaken by the Sibley College of Engineering, at the request of the Rockwood Manufacturing Company, manufacturers of the Rockwood Patented Paper Pulley.

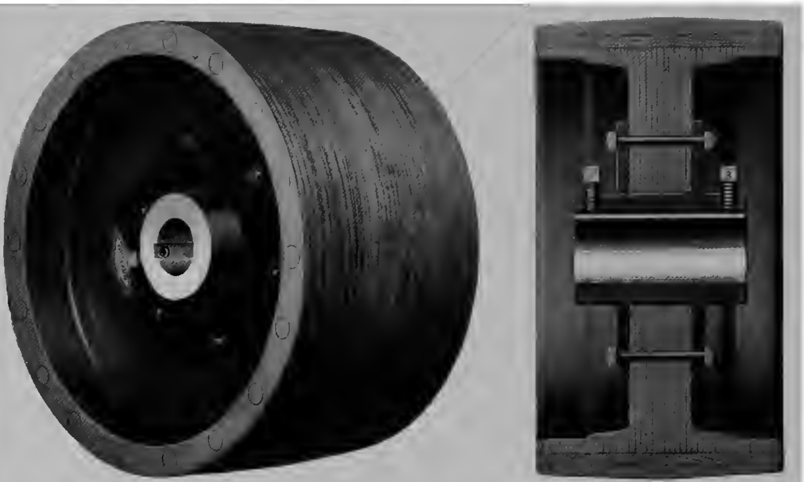
Wood pulleys of the solid type generally consist of a cast-iron hub upon which is fastened a rim built up of segments of well seasoned wood securely fastened together with glue and dowel-pins. They are also frequently made in the split form, and these are usually made entirely of wood. They all share the general disadvantage of wood constructions, *i. e.*, change under variation of atmospheric moisture conditions. In one respect they are much inferior to cast iron, and that is in the lack of uniformity of the quality of the surface, because in some places the ends of the grain are perpendicular to the surface, and at others the direction of the fibres is tangential to the surface. The former condition presents a good driving surface for the belt, the latter a surface which wears smooth and has little tractive power. The result is an uneven wearing surface, which, although it may be imperceptible to ordinary observation, is bound to have its effect on the life of the belt.

Another class of pulleys is made of paper fibre, of which there are two kinds, pulp pulleys and paper pulleys. Most people confound them as being the same thing, but the method of manufacture is radically different and causes a large difference in the quality of the resulting pulleys. In the making of pulp pulleys, straw paper scrap is reduced to pulp, which is put into molds and compressed and dried under pressure. The pulp boards thus formed, are from one-half to one inch thick. The fibres during this process are not arranged in a uniform or fixed direction, and consequently the resulting pulp board does not possess a grain. The strength of the boards is dependent, therefore, upon the bonding materials, which have to be used in considerable quantity. The pulp boards are glued together to build the pulley. The disadvantage of pulleys made of boards as above described, is that at the surface of the rim a large part of the fibres are tangential to the face, as is the case with some parts of the face of the wood pulley. Further, the bonding material soon glazes over the face under the action of the belt, and both the tangential fibres and bonding material tend to decrease the tractive power of the pulley.

The Rockwood Paper Pulley, while made of essentially the same raw material, is, owing to the difference in its manufacture, much superior to the pulp pulley above described, and is, as will be shown by the results of tests which follow, also superior to cast-iron and wood pulleys. The Rockwood Paper Pulley instead of being made of thick boards of grainless pulp, is built up of thin sheets of straw fibre, cemented together and compressed under hydraulic pressure. These sheets of straw fibre are not compressed from a mass of paper scrap, but are formed very much in the same way paper is made, and the result is a sheet which has definite longitudinal grain or fibre. In the manufacture of the pulley, the discs and rings forming the web and rim are cut from these sheets and are assembled so that the edges of the sheets form the face of the pulley, the ends of the fibres thus coming directly in contact with the belt. In assembling, the direction of the grain or fibre of alternate sheets is crossed, so that at all parts of the pulley face the fibres project outward, each individual fibre being thus in a position to exert a direct pull on the belt.

The tractive power of such a surface would naturally be greater than that presented by the hard surface of cast-iron, the irregular surface of the segments of a wood pulley, or the non-fibrous compound filled material of the pulp pulley. These advantages, while sufficiently evident from the structural details, are not presented without the evidence of actual demonstration by tests under service conditions, the results of which will be found in tables immediately following the mathematical discussion of the theory of belting.

The rims of paper and pulp pulleys in general are strengthened by wooden dowel-pins that extend through the rim and web, the latter corresponding to the arms of a cast-iron pulley. The webs are fastened to cast-iron hubs by clamping them with bolts between flanges secured to the hubs. The mechanical construction of the Rockwood Paper Pulley is shown by Fig. 1 on page 20. As will be appreciated from the illustrations, paper pulleys require little or no balancing, and are, therefore, not subjected to the irregular centrifugal strains caused by balance weights, and are consequently free from danger of bursting at ordinary speeds.



Standard Rockwood Paper Pulley

Small Motor Rockwood Paper Pulley

Fig. 1

ARRANGEMENT OF BELT DRIVES

With reference to the position of the shafts, we distinguish the following arrangements of belt drives.

a. Shafts parallel. In this case if the belt be an open belt, the driven shaft will rotate in the same direction as the driver. If the belt is a crossed belt, the direction of rotation of the driven shaft will be opposite.

b. Shafts at an angle so that the planes of the pulleys are at right angles to each other. This is the so-called quarter-twist drive.

c. Shafts at any angle but that mentioned under *b.* In this case guide pulleys are necessary, unless the pulleys are placed in one certain position, as pointed out later on.

In any drive this universal rule must never be lost sight of: *That the point at which the belt is delivered from any pulley must be in the plane of the other pulley.* (Unwin). This condition also determines whether any given belt drive is reversible, *i. e.*, can be operated in either direction.

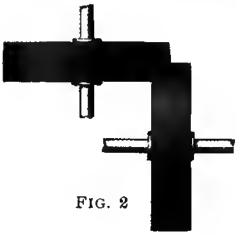


FIG. 2

The arrangement with parallel shafts need hardly be further discussed, being familiar to all. These drives are reversible. In the quarter-twist drive the pulleys are placed as in Fig. 2. If the lower shaft is to turn in the opposite direction from that indicated, the arrangement should be as in Fig. 3. A moment's study will show that this drive is not reversible.

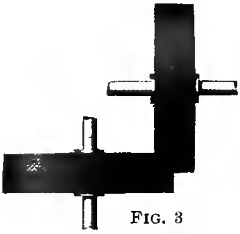


FIG. 3

If the shafts are at any angle *A*, driving without guide pulleys is still possible, as mentioned under *c*, if the pulleys are arranged as shown in Figs. 4 and 5. Again, these drives are not reversible.

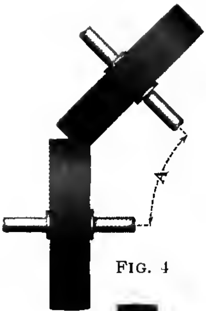


FIG. 4

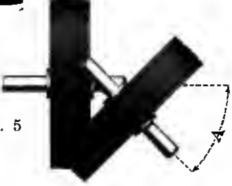


FIG. 5

Should the position of the pulleys or shaft at an angle not be a matter of choice, guide pulleys are required. These can be so arranged that the drive is reversible.

The manner of doing this is best shown by a diagram, Fig. 6. Suppose I and II are the two pulleys to be connected, and suppose also that the middle planes of these pulleys intersect in the line A B. It will then be necessary only to draw from any convenient points, such as 1 or 2, on this line, tangents to the pulley, as shown, and to place the planes of the guide pulleys in the planes determined by the tangents 1–3, 1–6 and 2–4, 2–5, respectively. This arrangement allows of the operation of the drive in either direction, but the guide pulleys have different axes.

If it is desired to operate in one direction only, it is possible to give the guide pulleys a common shaft. The guide pulleys should then be of the same size, with their planes perpendicular to the line A B. If it is desired to operate the drive in the direction of the arrow, one of these planes should touch the pulley I at the point 4, the other the pulley II at the point 6.

The above discussion is based on the assumption that the belt is a perfectly elastic band of infinitesimal cross-section. In practice several points come into play which change the conclusions somewhat. In any twisted belt drive outside of a crossed belt, the forces on the cross-section of the belt become unequally distributed, owing to the fact that one edge of the belt is always strained more than the other and sets up lateral forces which tend to run the belt to one side of the pulley. This tendency of a twisted belt to run to one side, to the side away from the

FIG. 6

point in which the axes of the shafts would cross, is variable in amount, depending both upon the degree of twist and the tension in the belt. The tendency decreases as the tension increases, and is therefore less in a tight than in a slack belt, and less in the tight than in the slack side of a twisted belt in operation. The remedy is to offset the pulleys somewhat from the positions dictated by theory. Take the case of Fig. 2 for instance, and suppose the upper pulley to be the driver rotating as shown by the arrow. In practice these pulleys should be offset as shown in Fig. 7. No definite values can be given for the offsets *a* and *b*, since much depends upon the quality and condition of the belt. Bach, in his "Maschinen-elemente," which contains an excellent discussion on belt gearing, makes $a=.5$ to $.6\,c$, and $b=.1$ to $.2\,c$, where c is the width of the belt.

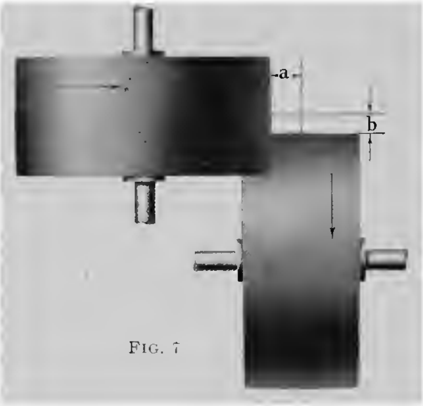
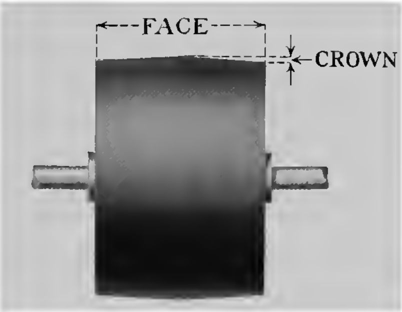


FIG. 7

CROWNING

Another practical point to be considered in this connection is the crowning of pulleys. Slight inaccuracies in the alignment of shafting, unequal wear of belt, bending of shafting, all these may cause the running of the belt to one side of the pulley. Again, should the belt be suddenly overloaded and slip, these things have a strong tendency to throw the belt completely off the pulley. In practice, however, none of these things can be entirely avoided, and the remedy for these evils is to crown the pulley. This causes the belt to run toward the high point of the crown, and materially reduces any tendency to one-sided running, or the belt leaving the pulley. There are two things, however, which should never be forgotten. In the first place there is a limit to the amount of inaccuracy that the crowning of the pulley will cure, and in the second, crowning is to be looked upon somewhat as a necessary evil. Running on a crowned pulley puts greater stress in that part of the belt running over the crown, and the crowning should therefore be as little as is consistent with safe operation. In parallel shafts, with either open or crossed belts, it is necessary to crown only one of the pulleys, and that should be the driven pulley. In a quarter-twist drive, crowning is entirely superfluous.



Standard Crowns for Pulleys

Face Inches	Crown Inches	Face Inches	Crown Inches	Face Inches	Crown Inches	Face Inches	Crown Inches	Face Inches	Crown Inches
2	$\frac{1}{32}$	10	⅛	20	$\frac{5}{32}$	30	$\frac{7}{32}$	40	¼
2½		11		21		31		41	
3	$\frac{3}{64}$	12		22		32		42	
3½		13	$\frac{9}{64}$	23	$\frac{3}{16}$	33		43	
4	$\frac{1}{16}$	14		24		34		44	
5		15		25		35		45	
6	$\frac{5}{64}$	16		26		36		46	
7		17	$\frac{5}{32}$	27		37		47	
8	$\frac{3}{32}$	18		28		38		48	
9		19		29		39	¼	49	

PART II

Theory of Belt Driving, Tests and Practical Formulæ Developed

EFFICIENCY OF CAST-IRON, WOOD, PULP AND PAPER PULLEYS

A. BELT SLIP

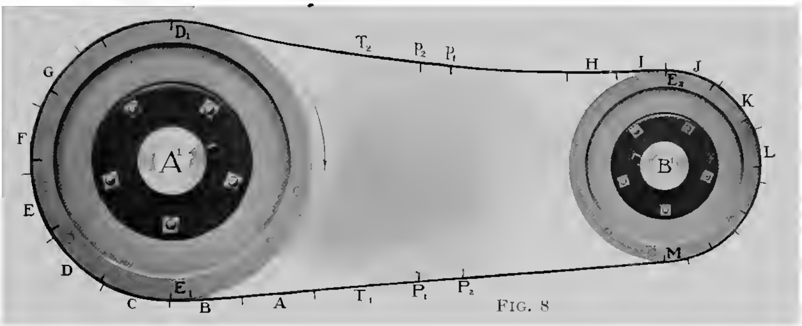


FIG. 8

Power cannot be transmitted without belt slip. Referring to Fig. 8, let A^1 be the driving and B^1 the driven pulley, rotating in the direction shown by the arrow. Let the tension in the tight side be T_1 and in the slack side T_2. Now, since the belt is an elastic band, if we take any two points on the tight side as P_1 and P_2, they will, when they have passed around the pulley to the position p_1 and p_2 on the slack side, be closer together than they were when on the tight side, because the belt is stretched to a greater extent on the tight side than it is on the slack side. This change in distance between the points considered does not take place suddenly, but gradually as the belt passes around the pulley. Let us mark off around the pulley a series of equal spaces, and on the tight side of the belt a number of spaces of the same length. Now, as these spaces move around the pulley from the point E_1 to the point D_1, the tension in each one of them will gradually change from T_1 at E_1 to T_2 at D_1. The first section, C, just beyond the point, E_1, will have slightly less tension than the section B, and will, therefore, be slightly shorter than the section B, and shorter than the equal spaces that were laid off around the pulley. The next section, D, will have slightly less tension and will be slightly shorter than C and so on through sections E, F, G, etc., around to the point D_1. It will thus be seen that each section from the point E_1 is lagging slightly behind that section of the pulley with which it was in contact at the point E_1, this lag increasing as we pass around the pulley and becoming considerable in amount at the final point of delivery of the belt from the pulley. It will thus be seen that these sections when they arrive at that point will have slipped over the surface of the pulley as they pass from E_1 to D_1. A similar action takes place on the driven pulley. The sections H and I, as they move into the positions J, K and L, have their tension and consequently their length gradually increased, until when they reach the point M on the tight side, they are sliding over the pulley with considerable velocity. This kind of slip, or creep, as it is sometimes called, is entirely distinct from any actual sliding of the belt over the pulley which may occur at the points of approach, E_1 and E_2. It is in fact probable that when the slip increases to the point where there is actual sliding at the points of approach, that the limit of practical transmission is reached, as beyond this the slip would increase very rapidly, and if the belt could be kept on, the slip would become 100 per cent., or complete slip, and no power would be transmitted. Owing to imperfect alignment of the pulleys or unequal stretching of the belt, this point is seldom reached as the belt leaves the pulleys soon after actual sliding at the point of approach begins. Slip or creep may be of considerable amount. It is, however, found that in good operation it is seldom in excess of 1 per cent. without causing noise and flapping of the belt, and other signs of distress, and this, therefore, may be called the commercial limit of the slip. The actual limit is, however, variable, and depends upon the straightness and uniformity of the belt and the alignment of the pulleys. Under the most favorable conditions one and one-half per cent. may be allowed.

While with a "commercial" slip of say 1 per cent. there is little difference as regards efficiency of transmission between various makes of belts and pulleys—the efficiency being in nearly all cases considerably over 90 per cent.—there is a decided difference between them as to the initial tension required to confine the slip to commercial limits. It is in this respect that some belts are better than others, and some pulleys are superior to others. For, if in any given belt drive a certain horse-power can be transmitted with a certain initial tension, and in a second belt drive of the same pulley and belt dimensions and the same speed the belt has to be two or three times as tight as in the first case to do the same work, evidently the first drive is the better, whether due to belt or pulley. High tensions mean larger friction losses in bearings and increased wear on belt, resulting in a decrease in the life of the belt and lower total efficiency. Or, looking at it in another way, if the first drive were keyed up to the tension of the second, it would transmit more power than the second drive before the commercial slip limit is reached, or a narrower belt could be used for the same power.

B. THE THEORY OF BELT TRANSMISSION

Suppose, referring to Fig. 9, that a belt passes around a pulley so that T_1 is the tension on the tight side and T_2 the tension on the slack side, the tractive effort, P, of the belt is then $T_1 - T_2$. The frictional resistance to slip

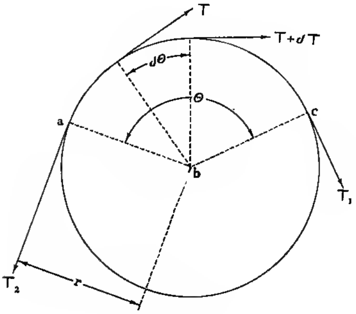


FIG. 9

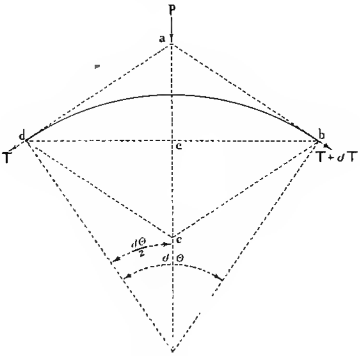


FIG. 10

is best determined by considering an infinitesimal part ds of the entire arc of contact, S. This small length of arc ds is that subtended by the angle $d\theta$ in Fig. 9. This arc is reproduced in Fig. 10 for the sake of clearness.

The resistance to slipping offered by any two surfaces in contact is the product of the normal pressure, p, on these surfaces multiplied by the coefficient of friction, f. That is, the frictional resistance offered is

$$F = p f$$

At one end of the arc $db = ds$ in Fig. 10, the tension is T, at the other end it may be considered equal to $T + dT$, although for our purpose dT may be neglected. The normal pressure, p, is the resultant of the tensions at the ends of this arc ds, = arc db. If ad and ab represent these two tensions, the resultant, p, is represented by the line ac. Now the angle $ade = \text{angle } \frac{d\theta}{2}$ and $ae = \frac{1}{2}\, ac = \frac{1}{2}\, p$.

$$\frac{ae}{ad} = \sin \frac{d\Theta}{2}$$

$$ae = ad \sin \frac{d\Theta}{2} = T \sin \frac{d\Theta}{2}$$

from which $p = 2\, ae = 2\, T \sin \frac{d\Theta}{2}$

This for our purpose may be written

$$p = T\, d\Theta \tag{1}$$

The normal force, p, with which the belt presses against the pulley is, however, decreased by the centrifugal force acting on the belt at the same time. The centrifugal force of the infinitesimal arc ds may be expressed by

$$ds \frac{q}{g} \frac{v^2}{r} \tag{2}$$

where q = the weight of belt one foot long, v = velocity of belt in feet per second, r = radius of pulley in feet, and g = 32.2. Now since $ds = r\, d\Theta$, (2) may be written

$$\text{Centrifugal force} = r\, d\Theta \frac{q}{g} \frac{v^2}{r} = \frac{q}{g} v^2\, d\Theta \tag{3}$$

The net normal force, p, is therefore

$$p = T\,d\,\Theta - \frac{q}{g}\,v^2\,d\,\Theta$$
$$= \left(T - \frac{q}{g}\,v^2\right) d\,\Theta$$

Multiplying this by the coefficient of friction, f, we have the total frictional resistance

$$F = \left(T - \frac{q}{g}\,v^2\right) d\,\Theta\,f \qquad (4)$$

On the assumption that any further increase in the tension T_1 causes complete slipping, we must have

$$d\,T = \left(T - \frac{q}{g}\,v^2\right) d\,\Theta\,f \qquad (5)$$

$$f\,d\,\Theta = \frac{d\,T}{\left(T - \frac{q}{g}\,v^2\right)} \qquad (6)$$

Integrating (6) between the limits of T_1 and T_2, we have

$$f\,d\,\Theta = \log \frac{T_1 - \frac{q}{g}\,v^2}{T_2 - \frac{q}{g}\,v^2} \qquad (7)$$

If the effect of centrifugal force had been neglected, equation (7) would have been

$$f\,d\,\Theta = \log \frac{T_1}{T_2} \qquad (8)$$

in which simpler form the theoretical result is most frequently stated. Equation (8) is safe for moderate speeds where the action of centrifugal force is much less felt.

By putting the tractive force

$$P = T_1 - T_2$$

and without entering into the details of the reduction, the following equations may be derived from equation (7)

$$T_1 = P\left(\frac{e^{f\,\Theta}}{e^{f\,\Theta} - 1}\right) + \frac{q}{g}\,v^2 \qquad (9)$$

$$T_2 = P\left(\frac{1}{e^{f\,\Theta} - 1}\right) + \frac{q}{g}\,v^2 \qquad (10)$$

$$P = \left(T_1 - \frac{q}{g}\,v^2\right)\frac{e^{f\,\Theta} - 1}{e^{f\,\Theta}} \qquad (11)$$

where e = base of natural logarithms = 2.718.

Again neglecting centrifugal force, equation (11) might have been written

$$P=T_1\left(1-\frac{1}{e^{f\Theta}}\right) \tag{12}$$

For those who do not care to follow the above mathematical deduction, the meaning of equation (12) becomes plain when we consider a concrete case. Suppose we assume that the arc of contact Θ is $180^\circ=3.14$ radians. For this case equation (12) reduces to

$$P=T_1\left(1-\frac{1}{23.2^f}\right)$$

Now since f is never a negative quantity, it appears that the greater the value of f, the smaller will be the quantity $\frac{1}{23.2^f}$ and the greater will P be. It appears therefore that any two similar drives running at the same speed will for the same T_1 and the same value of f, transmit the same horse-power. But this formula says nothing of the initial tension required to produce such value of f, or the slip which takes place at the same time. But in just these points lies the difference between various belts and pulleys. Confining the slip to commercial conditions may mean a much higher initial tension in one case than in another, and the relation between slip and the coefficient of friction, f, is therefore the most important feature of the whole case. The influence of the arc of contact, Θ, may be explained in the same manner. The greater the arc of contact, the greater the value of P, although it must not be assumed that P increases in the same proportion as Θ. Correction factors for reduction of calculated results to any desired arc of contact will be given in the tables following this discussion.

To determine the relation between slip and coefficient of friction various tests were made at Cornell University during the year 1904-05. These tests served to determine:

I. The initial tension in the belt.

II. The tensions in the slack and tight sides of the belt.

III. The amount of slip.

IV. The transmitted horse-power.

V The coefficient of friction.

The testing machine used (see Fig. 11 from Carpenter's Experimental Engineering), consists essentially of two parts: A, the tension carriage; B, the brake carriage, an arrangement for taking off power and for changing the tension in the belt. The machine is essentially that described by Mr. Wilfred Lewis in Vol. VIII, Transactions of the American Society of Mechanical Engineers.

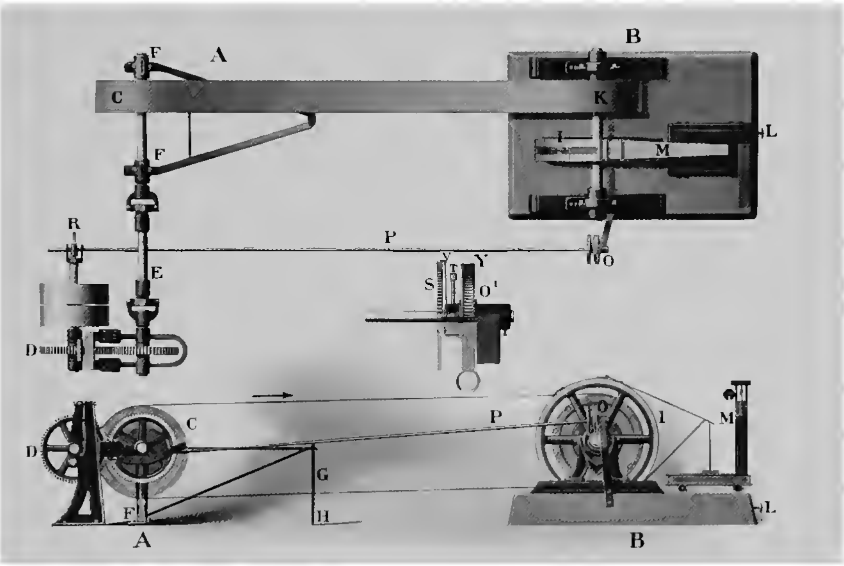


FIG. 11—BELT-TESTING MACHINE OF SIBLEY COLLEGE

Power is transmitted to the driving pulley, C, through the dynamometer, D, not used during this series of tests, and the universal coupling, E. The two bearings supporting the wheel, C, are held by a framework which is pivoted by thin steel plates at the points, F. This framework is free to swing about F, and, in this case, tends to swing to the right, according to the pull of the belt. This tendency to rotate is

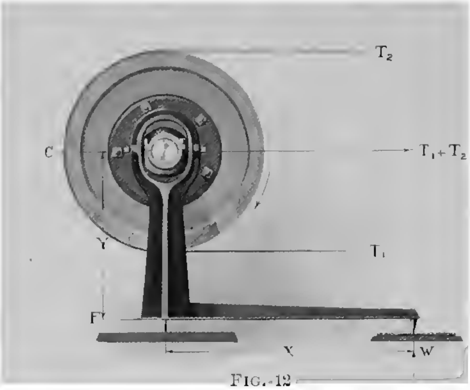


FIG. 12

measured by a scale placed under the support, G, at H. Fig. 12 shows the tension carriage diagrammatically. C is the driving pulley rotating as shown. The tension in the two ends of the belt may be represented by their resultant T_1+T_2 at the center of C. W represents in pounds the tendency of the frame to turn about the pivot, F. Assuming that the length of the horizontal arm=x, that of the vertical arm=y, we shall have summation of moments about point F

$$W x = (T_1 + T_2) y$$

from which we obtain

$$T_1 + T_2 = \frac{W x}{y}$$

The brake carriage, B, Fig. 11, supports the brake wheel, I, and the driven pulley, K. The carriage is mounted on rails and its distance from the tension carriage can be altered by means of the hand wheel and screw, L, thus changing the initial tension in the belt.

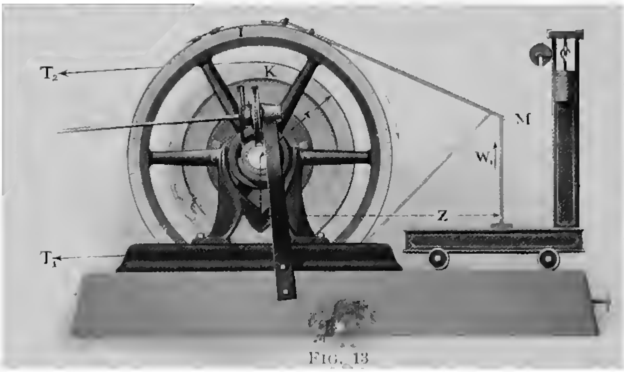


FIG. 13

By means of the brake, I, various loads are put into the belt, the brake reaction being measured by a scale at M. Fig. 13 shows the brake carriage in diagram. The belt tensions are again T_1 and T_2; let the radius of the driven pulley, K, be r, the reaction at M be W_1, and the length of the arm of the brake be Z; summing the moments about the center of K and I, we shall have

$$T_1 r = T_2 r + W_1 Z$$

from which

$$T_1 - T_2 = \frac{W_1 Z}{r}$$

Combining this with the equation obtained for the tension carriage we obtain

$$T_1 = \tfrac{1}{2}\left[\frac{w\,x}{y} + \frac{w_1 Z}{r}\right]$$

$$T_2 = \tfrac{1}{2}\left[\frac{w\,x}{y} - \frac{w_1 Z}{r}\right]$$

The revolutions of the driving pulley are obtained by tachometer or speed counter, those of the driven pulley by allowing for the slip as determined by an arrangement called the slip disc, shown at O, and in greater detail at O^1. The small shaft, P, is driven by means of worm and wheel at R at exactly $\frac{1}{100}$ the speed of the driving pulley. The disc, S (see detail O^1) is rigidly connected to this shaft, P, and is graduated into 100 equal parts at its circumference. The worm wheel, Y, is driven at exactly $\frac{1}{100}$ the speed of the driven pulley, and is of course loose on the shaft, P. To the hub of this wheel, Y, is fastened the pointer V, whose position can be changed by means of the set screw, T. Now it is evident that if there be no slip, the pointer, V, will remain at the mark at which it may be set on the circumference of S. But if slip occurs, it will lag behind this mark, and the amount of lag in one turn of S will be the slip direct in per cent.

The brake horse-power is computed from the formula

$$H\,P = \frac{2\,\pi\,W_1\,z\,n}{33{,}000}$$

where

W_1 = net brake load
z = length of brake arm in feet
n = r. p. m. for driven pulley

The coefficient of friction is determined by the formula

$$\frac{T_1}{T_2} = e^{f\,\theta}$$

neglecting centrifugal force, the arc θ being observed by a graduated disc placed near the driving pulley, C.

The pulleys used in the Sibley College tests were 24 inches in diameter by 8 inches face. Four sets were tested—cast iron, wood, pulp and paper. All were of standard make.

The belt was 5 inches wide, single, $\frac{3}{16}$ inches thick, oak tanned leather about 35 feet long, nearly new. The hair side was run next to pulley, according to accepted practice, and care was taken to have the belt in same condition for all tests. No belt dressing of any kind was used.

The method of test was also strictly the same in all cases. Starting with a slack belt at a certain measured initial tension, the load on the belt was increased in regular steps, until the belt ran off the pulley, owing to excessive slip or until the belt showed other signs of distress. Then a higher initial stress was put into the belt, by moving the brake carriage, and the belt again loaded up. This was continued until the last initial tension furnished what was thought to be a considerable overload for the belt. For each one of these conditions of initial tension and load, the readings outlined in the table on page 34 were either directly observed or computed.

The following tables and curves show the important results of the tests. The belt speed varied somewhat, being a little lower at high than at low loads, but the average may be taken at about 2,200 feet per minute.

TABLE I

Horse-power transmitted per inch of width of belt on various pulleys, for various conditions of tightness of belt and various rates of slip. Single leather belt. Belt speed average, 2,200 feet per minute

Initial Tension per Inch, in Pounds	PER CENT. OF SLIP															
	½ (Low)				1 (Average)				1½				2			
	Horse-power Transmitted per Inch of Width															
	Pulp	Wood	Cast-iron	Rock-wood Paper	Pulp	Wood	Cast-iron	Rock-wood Paper	Pulp	Wood	Cast-iron	Rock-wood Paper	Pulp	Wood	Cast-iron	Rock-wood Paper
20 (slack) .	.28	.30	.36	1.60	.40	.50	1.00	2.20	.52	.60	1.48	2.60	.60	.72	1.88	2.76
40 (fairly tight)	.70	.76	.84	2.34	.92	1.08	2.04	3.40	1.10	1.20	3.16	4.00	1.20	1.40	3.48	4.30
60 (tight)	1.10	1.17	.96	2.75	1.49	1.64	2.45	3.99	1.68	1.86	3.44	4.78	1.87	2.12	3.98	5.18
80 (very tight)	1.75	1.92	1.26	3.20	2.48	2.64	3.24	4.52	2.80	3.06	4.45	5.40	3.06	3.36	5.16	6.00

TABLE II

Initial tension per inch to be put into belt to produce a given horse-power per inch at various slips and on various pulleys. Single belt. Belt speed, 2,200 feet per minute

Horse-power per Inch	Corresponding Effective Tension per Inch. Belt Speed about 2,200 Feet per Minute	PER CENT. OF SLIP															
		½ (Low)				1.0 (Average)				1½				2			
		Pounds Initial Tension Required per Inch of Width															
		Pulp	Wood	Cast-iron	Rock-wood Paper	Pulp	Wood	Cast-iron	Rock-wood Paper	Pulp	Wood	Cast-iron	Rock-wood Paper	Pulp	Wood	Cast-iron	Rock-wood Paper
1	15	56	50	54	....	43	38	24	....	37	33	15	....	33	29		
2	30	82	77	....	25	70	66	40	17	65	60	27	13	60	55	21	
3	45	....	....	....	70	90	86	68	33	83	79	41	26	79	75	34	23
4	60	....	....	....	....	....	....	....	54	....	....	62	40	....	....	50	36
5	75	....	....	....	....	....	....	....	....	...	....	....	62	....	....	74	52

TABLE III

Relation between coefficient of friction and per cent. of slip for various initial tensions per inch and various pulleys. Single leather belt, condition dry. Belt speed, about 2,200 feet per minute

That pulley which at any given per cent. of slip shows the highest coefficient of friction will transmit more power than the others, other conditions being the same.

Initial Tension per Inch, in Pounds	Kind of Pulley	Pulp				Wood				Cast-iron				Rockwood Paper			
	Slip per Cent.	½	1(Av.)	1½	2	½	1(Av.	1½	2	½	1(Av.)	1½	2	½	1(Av.)	1½	2
		Coefficient of Friction															
20 (slack)		...	...	...	.29	...	...	.28	.31	...	.41	.57	.71	.67	.87	.99	1.23
40 (fairly tight) .		.19	.24	.28	.31	.20	.29	.33	.36	.20	.50	.74	.87	.54	.81	.93	1.00
60 (tight)		.22	.29	.32	.35	.21	.29	.35	.42	.17	.45	.71	.84	.45	.77	.98	
80 (very tight)		.24	.31	.34	.38	.24	.32	.38	.44	.14	.40	.65	.80	.37	.62	.96	
Average		.21	.29	.34	.37	.22	.31	.36	.39	.18	.46	.65	.79	.50	.76	.96	

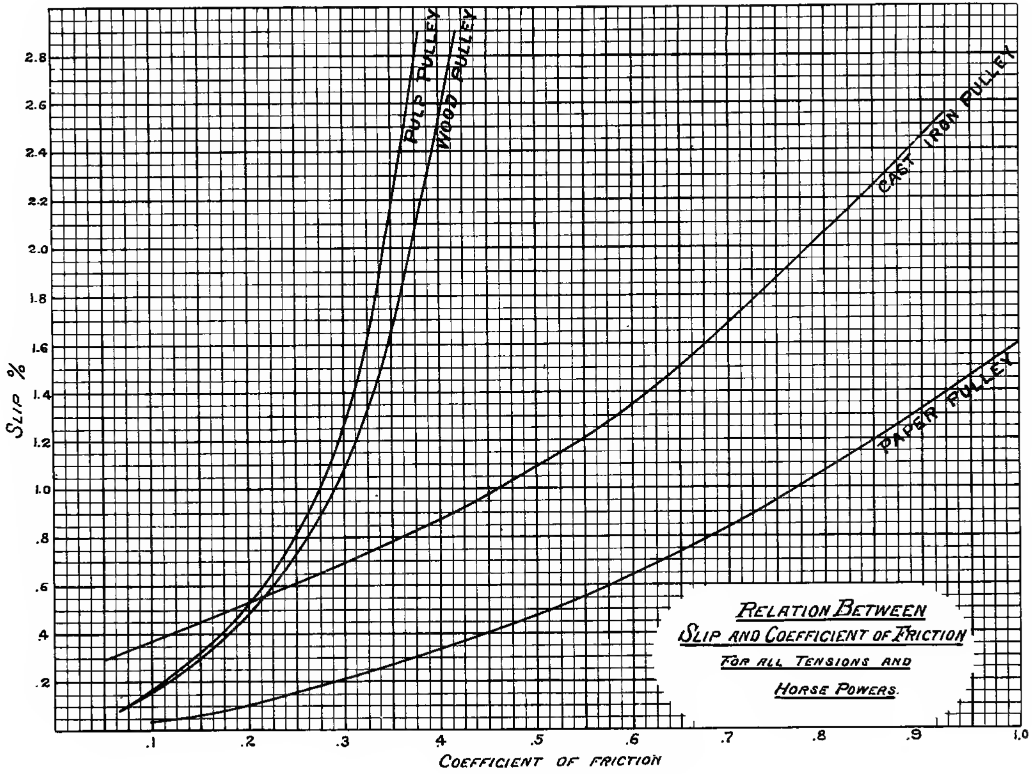
RELATION BETWEEN
SLIP AND COEFFICIENT OF FRICTION
FOR ALL TENSIONS AND
HORSE POWERS.
PULP PULLEY
WOOD PULLEY
CAST IRON PULLEY
PAPER PULLEY
SLIP %
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
COEFFICIENT OF FRICTION

FIG. 14

Tables I and II, as compiled from the Sibley College tests, hardly need any extended comment. They show clearly the superiority of the Rockwood Paper Pulley throughout the range of tests. In Table I, for instance, with a tight belt (60 pounds initial tension) and an allowable slip of 1 per cent., which may be taken to represent average practical conditions, the pulleys will transmit power in the following ratios, taking pulp as 1.0

Pulp	1.00
Wood	1.10
Cast-iron	1.65
Rockwood Paper	2.68

That is, the Rockwood Paper Pulley will, under the conditions outlined above, transmit 168 per cent. more power than a pulp pulley, and 50 per cent. more than a cast-iron pulley. Under other conditions, the gain is just as remarkable.

Another way of looking at this is presented in Table II. Taking 3 horse-power per inch of width as the average horsepower for single belting under the speed used in tests and with a commercial slip say of 1 per cent., the initial tensions required per inch in the belt to do this work bear the following relation to each other, taking that for the Rockwood paper as 1.0.

Pulp	2.73
Wood	2.60
Cast-iron	2.06
Rockwood Paper	1.0

This means that the initial tension per inch of belt required for pulp must be 2.73 times, and that for cast-iron 2.06 times that required for the Rockwood Paper Pulley. *It is hardly necessary to point out the advantage thus possessed by the Rockwood pulley, the evil of tight belts being known to every power user.*

There are thus two ways in which the superiority of the Rockwood pulley can be utilized: Under the same conditions more power can be transmitted, or, if this is not desirable, the same power can be transmitted with a much slacker belt, *meaning less loss in transmission and a longer life of belt.*

Table III presents figures for the coefficient of friction, which are thought to be of interest to the engineer in general.

Experiments on the coefficient of friction were made by Morin and by Towne and Briggs. Morin found that for leather on iron pulleys, the value of f was 0.56 when dry, 0.36 when wet, 0.23 when greasy and 0.15 when oily. Kent recommends that 0.15 be used for calculation if there be any probability that the belt become oily. Towne and Briggs, however, show that for ordinary cases f may be taken as equal to 0.42, while again, according to Kent, Releaux uses 0.25.

Before seeing how Table III agrees with these statements, it is well to point out that according to the results of these experiments the coefficient varies with the slip and the initial tension. At any given initial tension the coefficient increases as the slip increases. Since a low slip at any given tension means that only a part of the power of which the belt is capable is being transmitted, and the transmitted power increases with the slip up to an excessive point, this increase of the coefficient with slip is quite consistent.

It is not so easy to see why the coefficient should vary with the initial tension. An examination of the table will show that the variation is not at all regular. For pulp and wood there is generally an increase in the coefficient with an increase in the tension. For cast-iron there is no decided tendency, while for the Rockwood paper there is generally some decrease. The gains or losses in the coefficient with respect to initial tension are, however, not nearly as pronounced as they are for a change in the slip. As a matter of fact, by plotting all the values obtained for slip and coefficient of friction at all tensions over one another, curves (Fig. 14) can be drawn which represent this relation with sufficient accuracy for all ordinary computations. This amounts to averaging all the observed values of f at any given slip, and the averages so obtained are given in the bottom line of Table III.

Taking a slip value of 1 per cent. as average practical condition, the value 0.46 found by these experiments for cast-iron agrees well with that found by Towne and Briggs. Under the same conditions, the value 0.29 was found for pulp, 0.31 for wood and 0.76 for Rockwood paper.

Accepting these values, and assuming an arc of contact of 180 degrees, the tractive force under these conditions will then be for the same value of T_1, from eq. 12, p. 34, neglecting centrifugal effect:

Pulp	$P = 0.59\ T_1$
Wood	$= 0.62\ T_1$
Cast-iron	$= 0.76\ T_1$
Rockwood Paper	$= 0.91\ T_1$

The value of the ratio of $\frac{T_1}{T_2}$ has for a long time been taken by some authorities as equal to 2 in computations. In the tests under discussion this ratio varied as follows:

Pulp	1.22 to 7.50
Wood	1.23 to 8.66
Cast-iron	1.22 to 20.9
Rockwood Paper	1.22 to 58.3

For the values of P given above computed for values of f determined for 1 per cent. slip, and θ assumed = 180 degrees, the ratio of $\frac{T_1}{T_2}$ equals for

Pulp	2.45
Wood	2.65
Cast-iron	4.18
Rockwood Paper	11.10

These figures are in fair agreement with those found on tests at 1 per cent. slip for each initial tension, and again show the superiority of the Rockwood Paper Pulley, since for any given T_1, the smaller the value of T_2 the greater the tractive force.

BELT DRIVE COMPUTATIONS

I.—LENGTH OF BELTS

Whenever possible, this should be directly measured. If this cannot be done, there are accurate although quite complicated formulæ from which it may be obtained. A rule of thumb which gives the length approximately, is as follows:

Add together the diameters of the two pulleys, divide by 2, and multiply this result by 3¼. Add the resulting product to twice the distance between the centers of the shafts. Needless to say, that all dimensions must be either in feet or inches.

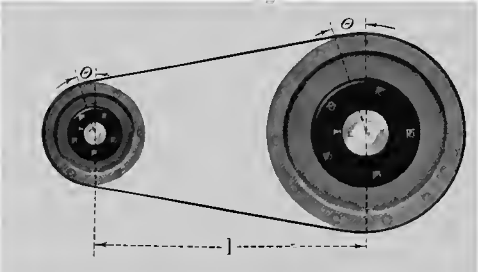


FIG. 15

The accurate formulæ are as follows:

1. Open belts.

Let l be the distance between centers of shafts, D, the diameter of the larger pulley, d, that of the smaller; Θ, the angle indicated in Fig. 15 in radians, and L the length of the belt.

$$L = \frac{\pi}{2}(D + d) + \Theta(D - d) + 2\,l\cos\Theta$$

2. Crossed belts.

For this case, with the same notation as above, we have

$$L = \left(\frac{\pi}{2} + \Theta\right)(D + d) + 2\,l\cos\Theta$$

In the cases of either open or crossed belts, the best method of procedure is first to determine the sine of the angle Θ. This for the open belt is $\sin\Theta = \frac{D - d}{2\,l}$ and for the crossed belt is $\sin\Theta = \frac{D + d}{2\,l}$. Then in any table of natural trigonometric functions, the value of $\sin\Theta$ determines that of $\cos\Theta$, and that of Θ in degrees, which must be reduced to radians. With these data the solution of the equations becomes easy.

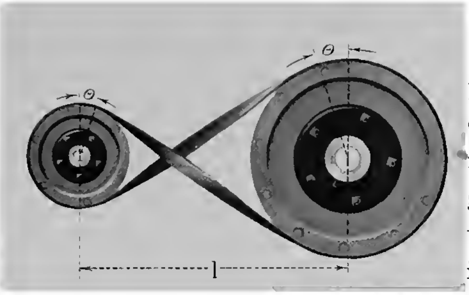


FIG. 16

3. It sometimes happens that it is desired to obtain the length of a belt in a given roll without going to the trouble of unrolling and measuring it. For this case Kent gives the following rule: The sum of the diameter of the roll and of the eye in inches multiplied by the number of turns made by the belt and by .1309 give length of belt in feet.

II.—HORSE-POWER

According to equation (11) of the previous chapter, the tractive force exerted by a belt equals

$$P = \left(T_1 - \frac{q}{g} v^2\right) \frac{e^{f\Theta} - 1}{e^{f\Theta}}$$

where

T_1 = tension in tight side
q = weight of belt one foot long
g = 32.2
v = velocity in ft.—sec
e = Naperian base = 2.718
f = coefficient of friction
Θ = arc of contact in radians

If we let P be the tractive force per square inch of cross section of belt, T_1 the tension in the tight side per square inch of cross section, q becomes the weight of 1 square inch of cross section of belt one foot long. The weight of leather may be taken at 56 pounds per cubic foot, from which the particular value of *q* becomes 0.39. Substituting this in the above equation, we have tractive force per square inch.

$$P = (T_1 - 0.012\, v^2) \frac{e^{f\Theta} - 1}{e^{f\Theta}}$$

If we let the width of the belt be W inches, the thickness be t″, the cross section

$$c = W\, t \text{ sq. inches}$$

The total tractive force in any given belt is then

$$P \text{ total} = (T_1 - .012\, v^2) \frac{e^{f\Theta} - 1}{e^{f\Theta}} W\, t$$

and if v is the velocity of the belt in feet per second, the horse-power transmitted will be

$$\text{H. P.} = \left[\frac{(T_1 - 0.012\,v^2)\,\dfrac{e^{f\Theta} - 1}{e^{f\Theta}}}{550} \right] W\,t\,v \qquad (13)$$

$$= K\,W\,t\,v \qquad (14)$$

where K stands for the factor:

$$\frac{(T_1 - .012v^2)\,\dfrac{e^{f\Theta} - 1}{e^{f\Theta}}}{550}$$

The formula as developed above is identical with that of Nagle reported to the American Society of Mechanical Engineers, 1881. The expression for K contains the variables T_1, v, f and Θ. It is possible, however, to assume average values for some of these and thus to compute values for K which will give formula (14) wide applicability.

In practice θ is probably as an average in the neighborhood of 180 degrees, which corresponds to 3.14 radians. To be on the safe side we will assume that $\theta = 3.0$.

Accepting 1 per cent. of slip as the practical commercial value, the average values of f were shown to be for

Pulp	f=0.29
Wood	=0.31
Cast-iron	=0.46
Rockwood Paper	=0.75

These values of f, however, were obtained under best conditions. To allow for some little leeway we will round them off as follows:

Pulp	f=0.25
Wood	=0.25
Cast-iron	=0.40
Rockwood Paper	=0.65

Some average value will have to be assumed for the factor v^2 in the expression for K. For moderate speeds the part $0.012\,v^2$ is of minor influence and the error will perhaps not be great if we assume the average belt speed at 1500 feet per minute, making v=25 feet per second.

In determining the average value of T_1, two points should be kept in mind, *i. e.*, the effect of the initial tension and that of the slip. In our case the slip is to have the commercial value of one per cent. The average figure for the initial tension is somewhat uncertain. Mr. Taylor, in his valuable paper, states that he keys his double belts up to about 240 pounds initial tension per square inch of cross section. This amounts to about 45 pounds per inch of width for a single belt. The experience of our tests has been that this is a rather slack belt. In fact most horse-power formula, on the basis of these tests, point to about 60 pounds per inch of single belt, or about 320 pounds per square inch of cross section as being nearer the average figure.

With an initial tension of 320 pounds per square inch, the tests show that the maximum tension, T_1, varies for the various pulleys when the slip value one per cent. is reached. This is, of course, consistent since the pulleys transmit various horse-powers under those conditions. The figures show that for one per cent. slip at 60 pounds tension the value of T_1 was as follows:

Pulp	$T_1=245$ pounds per square inch
Wood	$=255$ pounds per square inch
Cast-iron	$=290$ pounds per square inch
Rockwood Paper	$=380$ pounds per square inch

The value $T_1=290$ pounds, for cast-iron, is about what is ordinarily given for a laced belt, but 380 pounds is not at all excessive, and the belt on test showed no sign of distress at this load.

With the above assumptions for T_1, Θ, f and v, the value of K becomes for

Pulp	$K=0.23$
Wood	$=0.24$
Cast-iron	$=0.37$
Rockwood Paper	$=0.58$

The horse-power that will be transmitted, therefore, by the various pulleys, may be expressed by the following formulæ, for commercial conditions of one per cent. slip, 320 pounds per square inch initial tension, and θ near 3.14:

Pulp H. P. $=0.23\ w\ t\ v$
Wood . $=0.24\ w\ t\ v$
Cast-iron $=0.37\ w\ t\ v$
Rockwood Paper . $=0.58\ w\ t\ v$

The following table shows the horse-power transmitted by the various pulleys for the various speeds indicated, without considering centrifugal force, as computed from the above formulæ.

TABLE IV

Horse-power for Belt 1 Inch Wide. Initial Tension, 320 Pounds per Square Inch of Cross Section. Contact, 180 Degrees. Slip, 1 per cent.

Velocity, Feet		Pulp	Wood	Cast-iron	Rockwood Paper	Nagle's Formula for Cast-iron
Per Second	Per Minute					
10	600	.43	.45	.70	1.08	.73
20	1200	.86	.90	1.40	2.16	1.54
30	1800	1.29	1.35	2.10	3.24	2.25
40	2400	1.72	1.80	2.80	4.32	2.90
50	3000	2.15	2.25	3.50	5.40	3.48
60	3600	2.58	2.70	4.20	6.48	3.95
70	4200	3.01	3.15	4.90	7.56	4.29

LIMITATIONS OF THE ABOVE HORSE-POWER FORMULÆ.

1. For a velocity greater than $v=50$ feet per second, formula 13, page 48, should be used. At the higher speeds the centrifugal force commences to have an appreciable effect. As a comparison, the last column in Table IV shows the horse-powers at various speeds for a single belt, as given by Nagle, whose formula is in all respects identical, except that in this case the centrifugal effect has been taken into account for every value of v. It will be seen that above 50 feet per second, the horse-power shows an appreciable falling off over the result obtained by the more empirical formula above given.

2. If the arc of contact is very different from 3 radians, equal to about 180 degrees, again the unabridged formula 13 should be used. The horse-power increases or decreases with the arc of contact.

If conditions are otherwise unfavorable, either the full formula should be used, making proper allowances, or the the value of the constant *K* should be lowered. Crossed belts, for instance, while they increase the arc of contact, suffer loss through friction at the point of crossing. Allowance for this should be made if in connection with it the distance between centers should be comparatively short. For belts transmitting power which fluctuates considerably, the average horse-power to be transmitted should be used in the computations for belt dimensions, but the constant *K* should be decreased about 30 per cent. Belts which require constant shifting, those which run on small pulleys, or for those which operate in a vertical direction, or nearly so, special allowances should be made, decreasing the constant *K* as may be dictated by experience.

The following points should be kept in mind and worked to whenever possible.

For open belts, and transmission from a lower to a higher speed, have the highest points of the pulleys on a level; if this is not possible do not go below a 45 degree line. The lower side of the belt should be the tight side, because the sag of the upper side increases the arc of contact; 15 feet is the limit of distances between centers for belts not wider than 4 inches, and 30 feet to 45 feet is the upper limit for wider belts. For high speeds, pulleys must have their planes perpendicular to their shafts, and the pulleys should be balanced. Failure in the first of these requirements may cause a belt to weave from side to side, failure in the second may cause it to flop badly, the same effect as is produced by unsteady power.

In transmitting power from a higher to a slower speed, the same general precautions should be taken. The driving pulley is best not less than 18 inches if possible, and under certain extreme conditions, as for instance for dynamo and motor drives, it is safest to cut K by from 30 to 60 per cent.

If possible, arrange the shafting and machinery so that belts are led off from the driving shaft to each side. Have the pulleys delivering to opposite sides, in pairs, close together. This relieves the shaft largely of side strains and reduces journal friction.

If a belt, through stretching, refuses to transmit the maximum power it is called upon to transmit, it is best not to cut it at once but to give it an application of tallow. According to a German authority this makes the belt slip worse at first, but as soon as the belt absorbs the fat it shrinks about two per cent. of its length, which will make it take hold. Rosin and other sticky substances, while they may be effective for a little while, make a belt brittle and dry and will soon ruin it.

Comparatively narrow belts may be placed on their pulleys by sliding them on over the edge of the pulley. The same proceeding is not permissible with a wide and heavy belt, as the edge of the pulley may cut it. Such belts should be laced, while held on the pulleys, by the aid of belt clamps, and if they have to be thrown off, they should be slid from the driving pulley to an idler placed next to it.

RATIO OF TRANSMISSION

For approximate work the ratio of transmission is the ratio of the diameters of the pulleys. Taking a concrete case, let the diameter of driving pulley be 36 inches, that of the driven pulley be 15 inches, and the revolutions per minute of the driver be 200. The ratio of transmission is then

$$\frac{36}{15}=2.4$$

and revolutions per minute of driven pulley are

$$2.4\times200=480$$

For accurate work, however, it is necessary to consider both the thickness of the belt and the slip.

For a slip value, 1 per cent. may be assumed as before.

The thickness of the belt may be considered in at least two ways. It may be assumed that the radius of each pulley is increased by ½ the thickness of the belt. On the other hand, theoretical considerations show that the resultant of all the forces acting on the cross section of a belt passes about ⅓ of the thickness of the belt from the face of the driving, and about ⅔ of the thickness from the face of the driven pulley.

If we let r_1 and r_2 be the radii of the driving and driven pulleys respectively, t the thickness of the belt, and s the percentage of slip, we have the transmission ratio x in the first case.

$$x = \frac{r_1 + \frac{1}{2} t}{r_2 + \frac{1}{2} t} (1 - s)$$

in the second case

$$x = \frac{r_1 + \frac{1}{3} t}{r_2 + \frac{2}{3} t} (1 - s)$$

Suppose we let

$r_1 = 18''$, $r_2 = 7\frac{1}{2}''$, $t = \frac{5}{16}''$, $s = 1\%$, and R. P. M. of driver = 200.

Then

$$x = \frac{18 + \frac{5}{32}}{7\frac{1}{2} + \frac{5}{32}} (1 - .01) = 2.37$$

$$\text{R. P. M.} = 200 \times 2.37 = 474$$

or

$$x = \frac{18 \times \frac{5}{48}}{7\frac{1}{2} + \frac{10}{48}} (1 - .01) = 2.35$$

$$\text{R. P. M.} = 200 \times 2.35 = 470$$

as against

$$x = 2.4, \text{ and R. P. M.} = 480$$

for the approximate case.

PRESSURE ON THE JOURNALS DURING OPERATION

It can be shown that the axial pressure brought to bear by a belt in operation may be expressed by

$$\frac{1}{2} P \frac{e^{f\Theta} + 1}{e^{f\Theta} - 1} W t$$

where P is the tractive force per square inch of cross section of the belt, and e, f, Θ, W and t are as before.

Computing this axial pressure for the various pulleys, for $\Theta = 3.0$ radians, we have the following:

For pulp and wood, axial pressure . = 1.41 P W t
Cast-iron, axial pressure . . . . = .93 P W t
Rockwood paper . . = .67 P W t

At 1 per cent. slip, and an initial tension of 320 pounds per square inch we can substitute for P, and we have

Axial pressure for pulp = 178 w t
Axial pressure for wood = 186 w t
Axial pressure for cast-iron . . = 191 w t
Axial pressure for Rockwood paper = 213 w t

This axial pressure is distributed over the bearings depending on their position, and causes journal friction. But the above equations show that while there is some increase in the lost work in the case of the paper pulley over the others, such increased loss is by no means commensurate with the gain in horse-power transmitted.

TIGHTENER AND GUIDE PULLEYS

An idler pulley is employed for two reasons: To maintain a uniform tension in the belt and to increase the arc of contact. For these reasons tighteners should be placed on the slack side of the belt and near the smaller pulley.

In the case of angle drives, the guide pulley on the tight side of the belt should have about the diameter of the driving pulley, and about 1½ times its width of face. The guide pulley on the slack side should be about the size of the driven pulley with about two times its width of face.

PART III

Horse-power Tables for Rockwood Paper, Cast-iron, Wood and Pulp Pulleys

HORSE-POWER TABLES

The horse-powers in the following tables for pulp and wood, cast-iron and Rockwood Paper Pulleys are computed for an arc of contact of 180 degrees—*i. e.*, for pulleys of equal diameters belted together. When pulleys are of unequal diameters, multiply the horse-power obtained from the tables by the decimal found in the table below, under the given arc of contact. The effect of centrifugal force has been taken into account. The coefficient of friction was taken for wood, .25; cast-iron, .40; Rockwood Paper, .65, as determined on tests. Slip or creep is 1 per cent. Belt was oak-tanned leather, clean, with hair side to pulley.

Arc of Contact, Smaller Pulley . . .	120°	130°	140°	150°	160°	170°	180°
Pulp and Wood Pulleys	.76	.80	.84	.88	.93	.97	1.0
Cast-iron Pulley .	.79	.83	.87	.91	.94	.97	1.0
Rockwood Paper Pulleys	.87	.90	.92	.95	.97	.99	1.0

Horse-power Transmitted per Inch of Width by SINGLE LEATHER BELTS and ROCKWOOD PAPER PULLEYS

Diameter of Pulley	REVOLUTIONS PER MINUTE																			
	100	120	140	160	180	200	220	240	260	280	300	325	350	375	400	425	450	475	500	550
3	.15	.18	.20	.23	.26	.29	.32	.35	.38	.41	.44	.47	.50	.54	.58	.62	.65	.69	.73	.81
4	.20	.24	.28	.32	.36	.40	.43	.47	.51	.55	.59	.63	.67	.73	.78	.83	.87	.92	.97	1.07
5	.25	.29	.34	.39	.44	.49	.53	.58	.63	.68	.73	.79	.85	.91	.97	1.03	1.09	1.15	1.22	1.34
6	.30	.35	.41	.46	.52	.58	.64	.70	.76	.82	.88	.95	1.03	1.10	1.17	1.24	1.32	1.39	1.47	1.60
7	.34	.41	.47	.54	.61	.68	.75	.82	.89	.96	1.02	1.11	1.20	1.29	1.37	1.45	1.53	1.62	1.70	1.87
8	.39	.46	.54	.62	.70	.78	.86	.94	1.02	1.09	1.17	1.27	1.37	1.47	1.57	1.66	1.76	1.85	1.95	2.13
9	.44	.52	.61	.70	.78	.87	.96	1.05	1.14	1.23	1.32	1.42	1.53	1.64	1.75	1.86	1.97	2.08	2.18	2.40
10	.49	.58	.68	.78	.88	.97	1.07	1.17	1.27	1.37	1.47	1.58	1.70	1.82	1.95	2.08	2.20	2.31	2.43	2.67
11	.54	.64	.75	.86	.96	1.07	1.18	1.29	1.40	1.50	1.61	1.74	1.87	1.99	2.13	2.26	2.40	2.53	2.66	2.92
12	.59	.70	.82	.93	1.05	1.17	1.29	1.40	1.52	1.64	1.76	1.90	2.04	2.18	2.33	2.47	2.62	2.76	2.90	3.17
13	.63	.76	.89	1.01	1.14	1.27	1.40	1.52	1.65	1.78	1.90	2.06	2.22	2.36	2.53	2.68	2.83	2.98	3.13	3.42
14	.68	.82	.95	1.08	1.23	1.37	1.50	1.63	1.77	1.91	2.05	2.21	2.38	2.54	2.72	2.80	3.05	3.20	3.36	3.67
15	.73	.88	1.02	1.17	1.32	1.47	1.62	1.76	1.90	2.05	2.19	2.37	2.56	2.73	2.91	3.08	3.25	3.42	3.59	3.92
16	.78	.94	1.10	1.25	1.40	1.56	1.71	1.86	2.02	2.17	2.33	2.52	2.71	2.90	3.09	3.27	3.45	3.62	3.80	4.15
17	.83	.99	1.16	1.32	1.49	1.65	1.82	1.98	2.13	2.30	2.47	2.67	2.88	3.07	3.26	3.45	3.64	3.82	4.01	4.37
18	.88	1.06	1.24	1.41	1.58	1.76	1.93	2.09	2.26	2.44	2.62	2.83	3.04	3.25	3.45	3.65	3.85	4.04	4.23	4.64
19	.93	1.12	1.30	1.48	1.67	1.85	2.03	2.21	2.39	2.57	2.76	2.98	3.20	3.41	3.63	3.83	4.04	4.23	4.43	4.81
20	.97	1.17	1.36	1.56	1.75	1.94	2.13	2.32	2.51	2.70	2.90	3.12	3.35	3.58	3.80	4.01	4.22	4.43	4.64	5.02
21	1.02	1.23	1.43	1.64	1.84	2.04	2.24	2.44	2.64	2.84	3.04	3.27	3.51	3.75	3.99	4.21	4.43	4.63	4.83	5.22
22	1.07	1.28	1.49	1.71	1.92	2.13	2.34	2.54	2.75	2.96	3.17	3.43	3.68	3.92	4.17	4.39	4.61	4.82	5.03	5.43
23	1.12	1.34	1.57	1.79	2.01	2.22	2.44	2.66	2.88	3.10	3.32	3.57	3.82	4.08	4.32	4.56	4.78	5.00	5.22	5.63
24	1.17	1.40	1.65	1.87	2.09	2.32	2.55	2.77	3.00	3.23	3.46	3.72	3.98	4.24	4.49	4.72	4.95	5.17	5.41	5.83
25	1.22	1.46	1.71	1.94	2.18	2.43	2.66	2.89	3.13	3.36	3.59	3.87	4.13	4.39	4.64	4.89	5.13	5.36	5.60	6.04
26	1.27	1.52	1.77	2.02	2.27	2.52	2.76	2.99	3.23	3.48	3.72	4.01	4.28	4.54	4.80	5.05	5.30	5.54	5.77	6.21
27	1.32	1.58	1.83	2.09	2.35	2.61	2.87	3.11	3.35	3.60	3.84	4.14	4.43	4.69	4.96	5.21	5.47	5.71	5.93	6.37
28	1.37	1.63	1.90	2.17	2.43	2.70	2.97	3.22	3.47	3.72	3.96	4.27	4.57	4.84	5.12	5.38	5.63	5.87	6.10	6.51
29	1.41	1.70	1.97	2.25	2.52	2.80	3.07	3.33	3.58	3.83	4.08	4.39	4.70	4.94	5.26	5.52	5.78	6.02	6.26	6.66
30	1.46	1.75	2.03	2.32	2.61	2.89	3.16	3.43	3.70	3.96	4.21	4.53	4.84	5.12	5.40	5.67	5.93	6.17	6.41	6.80
31	1.51	1.81	2.10	2.40	2.70	2.98	3.27	3.54	3.82	4.08	4.34	4.66	4.97	5.27	5.55	5.82	6.08	6.32	6.55	6.93
32	1.56	1.87	2.18	2.49	2.80	3.08	3.37	3.66	3.93	4.20	4.47	4.78	5.09	5.41	5.69	5.97	6.23	6.47	6.68	7.06
33	1.61	1.93	2.25	2.57	2.88	3.18	3.47	3.76	4.04	4.33	4.59	4.91	5.23	5.54	5.85	6.11	6.37	6.60	6.82	7.18
34	1.66	1.98	2.32	2.64	2.95	3.26	3.57	3.86	4.15	4.44	4.71	5.04	5.37	5.68	5.97	6.24	6.50	6.72	6.93	7.28
35	1.71	2.04	2.38	2.71	3.03	3.35	3.67	3.97	4.26	4.55	4.83	5.17	5.50	5.83	6.10	6.37	6.62	6.84	7.04	7.38
36	1.75	2.10	2.45	2.78	3.11	3.44	3.75	4.06	4.36	4.66	4.95	5.30	5.63	5.95	6.23	6.49	6.73	6.95	7.14	7.45
37	1.80	2.16	2.51	2.85	3.19	3.53	3.84	4.16	4.47	4.78	5.07	5.42	5.75	6.07	6.36	6.60	6.84	7.06	7.24	7.50
38	1.85	2.21	2.57	2.93	3.28	3.62	3.94	4.27	4.59	4.88	5.18	5.53	5.87	6.18	6.48	6.72	6.94	7.15	7.33	7.55
39	1.90	2.27	2.65	3.00	3.36	3.71	4.04	4.37	4.70	4.99	5.29	5.64	5.99	6.30	6.58	6.83	7.05	7.25	7.40	7.60
40	1.96	2.34	2.71	3.07	3.42	3.78	4.12	4.47	4.80	5.10	5.41	5.75	6.10	6.40	6.69	6.93	7.15	7.33	7.47	7.65
41	2.01	2.40	2.77	3.13	3.50	3.87	4.22	4.57	4.91	5.23	5.51	5.86	6.20	6.50	6.78	7.02	7.23	7.40	7.53	7.70
42	2.06	2.46	2.84	3.22	3.59	3.96	4.33	4.66	5.00	5.32	5.60	5.98	6.30	6.60	6.88	7.12	7.31	7.47	7.57	
43	2.11	2.51	2.90	3.28	3.67	4.05	4.42	4.76	5.09	5.42	5.72	6.09	6.42	6.70	6.97	7.20	7.39	7.52	7.62	
44	2.16	2.57	2.97	3.37	3.76	4.14	4.50	4.84	5.18	5.51	5.82	6.19	6.52	6.80	7.07	7.28	7.45	7.58	7.67	
45	2.21	2.64	3.05	3.45	3.84	4.23	4.59	4.95	5.29	5.62	5.93	6.29	6.62	6.89	7.14	7.35	7.51	7.63	7.70	
46	2.26	2.69	3.10	3.51	3.91	4.31	4.69	5.05	5.40	5.72	6.03	6.39	6.72	6.98	7.23	7.43	7.57	7.66		
47	2.30	2.73	3.16	3.57	3.98	4.39	4.77	5.13	5.49	5.81	6.13	6.48	6.81	7.07	7.29	7.48	7.61	7.69		
48	2.34	2.78	3.21	3.64	4.07	4.47	4.85	5.22	5.58	5.91	6.22	6.57	6.89	7.13	7.36	7.53	7.65	7.72		
49	2.39	2.84	3.28	3.71	4.14	4.55	4.93	5.30	5.67	6.00	6.32	6.67	6.97	7.21	7.42	7.58	7.68			
50	2.43	2.89	3.34	3.78	4.20	4.62	5.02	5.40	5.76	6.09	6.41	6.75	7.05	7.28	7.48	7.62	7.71			
51	2.47	2.95	3.41	3.85	4.28	4.70	5.10	5.48	5.85	6.18	6.50	6.83	7.12	7.35	7.53	7.65				
52	2.52	3.00	3.47	3.92	4.36	4.78	5.18	5.58	5.93	6.27	6.58	6.90	7.18	7.40	7.58	7.68				
53	2.57	3.06	3.54	4.00	4.44	4.86	5.27	5.65	6.02	6.35	6.66	6.98	7.25	7.46	7.62	7.71				
54	2.62	3.12	3.60	4.07	4.52	4.92	5.36	5.74	6.10	6.43	6.73	7.05	7.32	7.51	7.65					
55	2.67	3.17	3.67	4.14	4.60	5.02	5.45	5.83	6.19	6.50	6.80	7.12	7.37	7.55	7.68					
56	2.72	3.22	3.72	4.20	4.66	5.10	5.52	5.90	6.26	6.58	6.87	7.18	7.42	7.60	7.70					
57	2.76	3.27	3.77	4.26	4.73	5.17	5.58	5.97	6.34	6.66	6.94	7.24	7.47	7.63	7.72					
58	2.80	3.33	3.84	4.32	4.79	5.24	5.67	6.06	6.42	6.73	7.00	7.30	7.52	7.66						
59	2.84	3.38	3.90	4.39	4.87	5.32	5.75	6.14	6.50	6.80	7.07	7.35	7.56	7.68						
60	2.88	3.43	3.96	4.45	4.93	5.39	5.82	6.21	6.57	6.88	7.13	7.40	7.60	7.70						

Horse-power Transmitted per Inch of Width by SINGLE LEATHER BELTS and ROCKWOOD PAPER PULLEYS—*Continued*

Diameter of Pulley	REVOLUTIONS PER MINUTE																		
	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
3	.88	.94	1.01	1.07	1.14	1.22	1.30	1.38	1.46	1.59	1.73	1.87	2.02	2.16	2.30	2.45	2.60	2.74	2.88
4	1.16	1.26	1.35	1.44	1.54	1.65	1.75	1.85	1.94	2.12	2.31	2.50	2.70	2.89	3.08	3.26	3.43	3.60	3.76
5	1.46	1.58	1.70	1.82	1.95	2.07	2.20	2.32	2.43	2.65	2.88	3.12	3.34	3.56	3.78	4.00	4.21	4.42	4.63
6	1.75	1.90	2.05	2.19	2.34	2.48	2.62	2.76	2.90	3.16	3.43	3.70	3.96	4.20	4.46	4.70	4.93	5.16	5.38
7	2.04	2.21	2.37	2.54	2.70	2.87	3.02	3.18	3.35	3.65	3.96	4.25	4.53	4.80	5.08	5.35	5.61	5.85	6.09
8	2.33	2.52	2.70	2.89	3.07	3.26	3.44	3.61	3.78	4.13	4.47	4.79	5.09	5.40	5.69	5.97	6.22	6.45	6.66
9	2.61	2.82	3.02	3.23	3.43	3.63	3.83	4.02	4.21	4.59	4.95	5.29	5.61	5.92	6.22	6.48	6.74	6.95	7.14
10	2.90	3.13	3.35	3.57	3.80	4.01	4.22	4.42	4.63	5.02	5.40	5.77	6.12	6.41	6.68	6.94	7.16	7.33	7.47
11	3.17	3.42	3.66	3.90	4.14	4.36	4.58	4.80	5.01	5.42	5.83	6.19	6.51	6.80	7.05	7.27	7.45	7.58	7.67
12	3.44	3.71	3.97	4.22	4.47	4.72	4.95	5.17	5.39	5.82	6.22	6.57	6.87	7.13	7.35	7.53	7.65	7.73	
13	3.71	4.00	4.27	4.53	4.79	5.05	5.29	5.52	5.75	6.17	6.57	6.90	7.18	7.40	7.57	7.68			
14	3.98	4.27	4.55	4.84	5.11	5.37	5.62	5.86	6.09	6.52	6.88	7.18	7.42	7.59	7.70				
15	4.24	4.54	4.84	5.12	5.40	5.67	5.92	6.17	6.40	6.79	7.13	7.38	7.58	7.70					
16	4.49	4.80	5.11	5.41	5.70	5.96	6.21	6.45	6.65	7.06	7.37	7.58	7.70						
17	4.71	5.02	5.35	5.67	5.96	6.22	6.46	6.68	6.88	7.29	7.53	7.70							
18	4.95	5.27	5.60	5.91	6.20	6.48	6.73	6.93	7.10	7.45	7.68								
19	5.17	5.51	5.86	6.16	6.43	6.70	6.94	7.14	7.32	7.57	7.72								
20	5.38	5.74	6.08	6.39	6.67	6.92	7.13	7.30	7.45	7.67									
21	5.62	5.98	6.30	6.62	6.89	7.12	7.30	7.46	7.58	7.74									
22	5.83	6.18	6.50	6.80	7.07	7.28	7.44	7.55	7.65										
23	6.04	6.40	6.70	6.98	7.22	7.43	7.58	7.63											
24	6.22	6.57	6.89	7.15	7.35	7.52	7.61	7.68											
25	6.40	6.73	7.05	7.32	7.52	7.65	7.74												
26	6.58	6.91	7.18	7.40	7.57	7.69													
27	6.76	7.07	7.30	7.48	7.63	7.73													
28	6.89	7.18	7.41	7.57	7.69														
29	7.02	7.30	7.52	7.70															
30	7.13	7.41	7.62	7.75															
31	7.25	7.50	7.67																
32	7.36	7.58	7.70																
33	7.45	7.61																	
34	7.53	7.69																	
35	7.60	7.72																	
36	7.65																		
37	7.68																		
38	7.70																		
39	7.72																		

For an arc of contact less than 180° multiply by a correction coefficient as per the following table:

Arc of contact	120°	130°	140°	150°	160°	170°	180°
Coefficient .	.87	.90	.92	.95	.97	.99	1.0

Horse-power Transmitted per Inch of Width by DOUBLE LEATHER BELTS and ROCKWOOD PAPER PULLEYS

Diameter of Pulley	REVOLUTIONS PER MINUTE																			
	100	120	140	160	180	200	220	240	260	280	300	325	350	375	400	425	450	475	500	550
3	.24	.28	.33	.38	.42	.47	.52	.56	.61	.66	.71	.77	.82	.88	.93	.99	1.06	1.12	1.18	1.29
4	.32	.38	.45	.51	.57	.63	.70	.76	.83	.89	.95	1.02	1.10	1.18	1.26	1.33	1.41	1.49	1.57	1.72
5	.40	.48	.56	.63	.71	.78	.86	.93	1.01	1.09	1.18	1.27	1.37	1.47	1.57	1.67	1.76	1.86	1.96	2.15
6	.48	.57	.67	.76	.86	.95	1.05	1.14	1.24	1.33	1.42	1.53	1.65	1.78	1.90	2.02	2.11	2.24	2.37	2.61
7	.55	.66	.77	.88	1.00	1.11	1.22	1.33	1.44	1.55	1.66	1.79	1.93	2.07	2.21	2.35	2.49	2.63	2.77	3.05
8	.63	.77	.90	1.02	1.15	1.27	1.39	1.52	1.65	1.77	1.90	2.05	2.21	2.37	2.54	2.68	2.84	3.00	3.17	3.47
9	.71	.85	1.00	1.14	1.28	1.42	1.56	1.70	1.85	1.99	2.14	2.29	2.47	2.65	2.83	3.01	3.20	3.37	3.55	3.88
10	.80	.95	1.10	1.26	1.42	1.57	1.73	1.89	2.04	2.20	2.36	2.55	2.75	2.95	3.16	3.35	3.55	3.75	3.94	4.30
11	.88	1.05	1.22	1.40	1.57	1.74	1.91	2.08	2.25	2.42	2.60	2.81	3.04	3.25	3.47	3.68	3.89	4.10	4.31	4.71
12	.96	1.14	1.34	1.53	1.72	1.90	2.09	2.29	2.46	2.65	2.85	3.08	3.33	3.55	3.78	4.02	4.24	4.47	4.70	5.12
13	1.03	1.24	1.44	1.65	1.85	2.07	2.27	2.47	2.67	2.88	3.09	3.34	3.60	3.85	4.09	4.35	4.58	4.83	5.08	5.53
14	1.10	1.33	1.55	1.78	1.99	2.21	2.43	2.65	2.88	3.10	3.33	3.61	3.88	4.15	4.40	4.67	4.93	5.19	5.45	5.93
15	1.18	1.41	1.65	1.89	2.12	2.36	2.59	2.83	3.07	3.31	3.55	3.85	4.14	4.42	4.69	4.98	5.26	5.52	5.79	6.32
16	1.25	1.50	1.75	2.00	2.25	2.51	2.77	3.02	3.27	3.52	3.77	4.09	4.40	4.70	4.99	5.29	5.57	5.85	6.13	6.68
17	1.33	1.60	1.87	2.13	2.40	2.67	2.95	3.21	3.48	3.75	4.01	4.35	4.67	5.00	5.28	5.59	5.88	6.18	6.47	7.05
18	1.42	1.70	1.98	2.27	2.56	2.84	3.12	3.40	3.67	3.96	4.25	4.60	4.94	5.30	5.55	5.90	6.22	6.53	6.82	7.42
19	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.89	4.18	4.47	4.85	5.22	5.58	5.88	6.20	6.53	6.88	7.15	7.77
20	1.57	1.88	2.20	2.52	2.84	3.15	3.47	3.78	4.08	4.38	4.70	5.10	5.47	5.85	6.13	6.49	6.85	7.18	7.50	8.12
21	1.65	1.98	2.31	2.65	2.97	3.30	3.63	3.96	4.28	4.60	4.92	5.33	5.69	6.07	6.42	6.77	7.16	7.49	7.83	8.46
22	1.74	2.06	2.41	2.76	3.08	3.43	3.78	4.12	4.46	4.81	5.15	5.56	5.94	6.30	6.69	7.07	7.47	7.82	8.16	8.81
23	1.82	2.16	2.51	2.88	3.20	3.59	3.94	4.32	4.66	5.02	5.37	5.80	6.19	6.59	6.98	7.36	7.76	8.12	8.49	9.14
24	1.90	2.25	2.63	3.00	3.36	3.75	4.12	4.60	4.86	5.23	5.67	6.04	6.47	6.88	7.25	7.63	8.03	8.43	8.80	9.44
25	1.98	2.35	2.74	3.14	3.51	3.92	4.30	4.68	5.07	5.43	5.83	6.27	6.70	7.12	7.50	7.90	8.32	8.70	9.07	9.73
26	2.06	2.45	2.85	3.26	3.67	4.08	4.47	4.86	5.25	5.63	6.03	6.49	6.93	7.37	7.77	8.18	8.58	8.97	9.33	10.00
27	2.14	2.55	2.98	3.42	3.82	4.24	4.65	5.05	5.46	5.83	6.23	6.70	7.16	7.58	8.00	8.43	8.84	9.25	9.60	10.27
28	2.22	2.65	3.09	3.53	3.96	4.38	4.80	5.22	5.63	6.02	6.42	6.90	7.38	7.81	8.26	8.69	9.11	9.52	9.88	10.53
29	2.29	2.73	3.18	3.63	4.09	4.54	4.97	5.40	5.82	6.21	6.64	7.11	7.58	8.04	8.51	8.93	9.35	9.77	10.15	10.80
30	2.37	2.83	3.31	3.78	4.25	4.70	5.15	5.58	6.00	6.41	6.85	7.35	7.82	8.29	8.74	9.16	9.58	10.01	10.38	11.03
31	2.45	2.92	3.41	3.89	4.38	4.84	5.31	5.76	6.19	6.61	7.04	7.56	8.06	8.54	8.98	9.42	9.82	10.22	10.60	11.23
32	2.53	3.02	3.53	4.02	4.52	4.99	5.47	5.94	6.37	6.80	7.23	7.75	8.24	8.75	9.21	9.66	10.07	10.47	10.82	11.43
33	2.61	3.12	3.63	4.15	4.65	5.14	5.63	6.11	6.55	6.98	7.43	7.95	8.46	8.97	9.44	9.88	10.29	10.68	11.02	11.63
34	2.69	3.22	3.75	4.28	4.79	5.28	5.79	6.28	6.73	7.18	7.62	8.16	8.67	9.19	9.68	10.10	10.51	10.90	11.22	11.80
35	2.77	3.32	3.87	4.39	4.92	5.43	5.94	6.45	6.91	7.36	7.82	8.35	8.89	9.39	9.89	10.32	10.73	11.10	11.40	11.95
36	2.84	3.40	3.97	4.50	5.06	5.56	6.08	6.59	7.07	7.54	8.02	8.56	9.10	9.60	10.10	10.51	10.90	11.27	11.55	12.05
37	2.92	3.50	4.07	4.61	5.17	5.70	6.22	6.74	7.25	7.73	8.21	8.77	9.33	9.83	10.30	10.70	11.07	11.44	11.72	12.15
38	3.00	3.60	4.18	4.74	5.31	5.85	6.37	6.90	7.40	7.90	8.40	8.97	9.53	10.02	10.50	10.89	11.24	11.59	11.88	12.23
39	3.08	3.70	4.28	4.86	5.44	6.00	6.53	7.05	7.58	8.08	8.59	9.14	9.71	10.20	10.66	11.07	11.41	11.74	12.00	12.31
40	3.17	3.79	4.38	4.97	5.55	6.18	6.68	7.28	7.78	8.26	8.78	9.34	9.69	10.36	10.83	11.22	11.57	11.87	12.10	12.39
41	3.26	3.89	4.49	5.09	5.67	6.26	6.84	7.41	7.95	8.45	8.94	9.50	10.05	10.52	10.99	11.38	11.72	11.99	12.19	12.47
42	3.34	3.98	4.61	5.21	5.80	6.40	7.00	7.57	8.10	8.62	9.10	9.68	10.22	10.68	11.14	11.53	11.87	12.10	12.26	
43	3.42	4.07	4.71	5.33	5.95	6.54	7.16	7.72	8.25	8.77	9.27	9.86	10.40	10.86	11.31	11.67	11.99	12.20	12.34	
44	3.50	4.16	4.81	5.46	6.09	6.70	7.30	7.87	8.41	8.95	9.44	10.02	10.56	11.01	11.45	11.79	12.10	12.30	12.42	
45	3.58	4.26	4.92	5.59	6.22	6.85	7.44	8.02	8.57	9.11	9.60	10.19	10.72	11.15	11.57	11.91	12.18	12.37	12.49	
46	3.66	4.35	5.02	5.69	6.34	6.99	7.59	8.17	8.74	9.26	9.76	10.35	10.89	11.30	11.70	12.04	12.26	12.41		
47	3.73	4.44	5.12	5.79	6.47	7.12	7.73	8.32	8.90	9.42	9.93	10.50	11.04	11.45	11.80	12.12	12.34	12.45		
48	3.80	4.52	5.22	5.90	6.59	7.25	7.86	8.46	9.05	9.57	10.10	10.66	11.17	11.55	11.91	12.20	12.40	12.50		
49	3.87	4.60	5.32	6.01	6.70	7.37	8.00	8.60	9.20	9.73	10.25	10.80	11.29	11.69	12.01	12.29	12.45			
50	3.94	4.69	5.42	6.13	6.82	7.49	8.15	8.75	9.35	9.86	10.39	10.95	11.42	11.81	12.11	12.35	12.49			
51	4.01	4.78	5.52	6.24	6.94	7.61	8.29	8.90	9.48	10.01	10.53	11.08	11.53	11.90	12.20	12.40				
52	4.08	4.86	5.62	6.35	7.07	7.75	8.43	9.04	9.62	10.15	10.66	11.19	11.63	12.00	12.28	12.45				
53	4.16	4.96	5.74	6.47	7.20	7.88	8.57	9.18	9.75	10.29	10.78	11.30	11.75	12.09	12.34	12.49				
54	4.24	5.05	5.84	6.59	7.33	8.02	8.70	9.31	9.89	10.42	10.90	11.41	11.88	12.18	12.40					
55	4.32	5.14	5.94	6.70	7.45	8.16	8.83	9.45	10.03	10.54	11.01	11.53	11.96	12.25	12.44					
56	4.40	5.22	6.03	6.81	7.55	8.26	8.93	9.56	10.16	10.67	11.13	11.62	12.05	12.30	12.48					
57	4.47	5.30	6.12	6.90	7.66	8.39	9.07	9.69	10.28	10.81	11.24	11.72	12.12	12.36	12.50					
58	4.54	5.40	6.22	7.01	7.78	8.55	9.20	9.82	10.40	10.91	11.33	11.82	12.20	12.42						
59	4.62	5.48	6.32	7.12	7.90	8.63	9.32	9.95	10.52	11.02	11.43	11.90	12.27	12.45						
60	4.68	5.56	6.41	7.21	8.00	8.74	9.45	10.08	10.64	11.14	11.53	12.00	12.32	12.49						

Horse-power Transmitted per Inch of Width by DOUBLE LEATHER BELTS and ROCKWOOD PAPER PULLEYS—*Continued*

Diameter of Pulley	Revolutions per Minute																		
	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
3	1.40	1.52	1.63	1.75	1.87	1.99	2.11	2.22	2.33	2.57	2.80	3.03	3.28	3.50	3.73	3.98	4.22	4.46	4.70
4	1.88	2.04	2.19	2.35	2.51	2.66	2.82	2.97	3.13	3.45	3.76	4.07	4.37	4.68	4.98	5.27	5.56	5.83	6.10
5	2.35	2.57	2.75	2.95	3.15	3.34	3.53	3.72	3.91	4.30	4.69	5.05	5.40	5.77	6.12	6.47	6.82	7.17	7.50
6	2.86	3.08	3.31	3.54	3.78	4.02	4.25	4.48	4.70	5.15	5.57	6.00	6.41	6.82	7.23	7.62	8.00	8.36	8.72
7	3.32	3.60	3.86	4.13	4.39	4.65	4.92	5.18	5.43	5.92	6.41	6.88	7.35	7.80	8.25	8.66	9.07	9.46	9.85
8	3.78	4.10	4.39	4.69	4.98	5.27	5.56	5.85	6.12	6.70	7.23	7.75	8.27	8.75	9.22	9.67	10.08	10.46	10.80
9	4.24	4.58	4.93	5.26	5.57	5.89	6.22	6.53	6.83	7.43	8.00	8.56	9.08	9.57	10.07	10.50	10.90	11.23	11.55
10	4.70	5.03	5.43	5.81	6.15	6.50	6.85	7.19	7.52	8.14	8.75	9.34	9.88	10.36	10.83	11.21	11.57	11.86	12.10
11	5.15	5.53	5.92	6.32	6.70	7.08	7.46	7.77	8.12	8.82	9.45	10.02	10.54	11.00	11.44	11.80	12.08	12.28	12.42
12	5.58	6.00	6.41	6.83	7.23	7.62	8.02	8.39	8.75	9.42	10.08	10.65	11.13	11.55	11.91	12.20	12.38	12.50	
13	6.00	6.45	6.89	7.34	7.74	8.15	8.55	8.95	9.30	10.00	10.62	11.20	11.63	12.00	12.25	12.45			
14	6.43	6.90	7.38	7.82	8.26	8.68	9.09	9.48	9.86	10.54	11.15	11.65	12.05	12.30	12.47				
15	6.84	7.34	7.83	8.29	8.73	9.18	9.58	9.98	10.35	11.00	11.57	11.98	12.30	12.47					
16	7.24	7.74	8.25	8.75	9.21	9.67	10.07	10.46	10.82	11.43	11.95	12.27	12.37						
17	7.61	8.15	8.67	9.19	9.65	10.08	10.49	10.85	11.17	11.80	12.18	12.47							
18	8.00	8.55	9.08	9.58	10.08	10.49	10.87	11.21	11.50	12.05	12.41								
19	8.37	8.96	9.52	9.90	10.45	10.85	11.23	11.56	11.87	12.28	12.52								
20	8.73	9.32	9.88	10.33	10.78	11.19	11.55	11.83	12.06	12.45									
21	9.09	9.68	10.23	10.69	11.14	11.53	11.85	12.07	12.23	12.52									
22	9.45	10.02	10.54	11.01	11.47	11.82	12.09	12.25	12.40										
23	9.79	10.36	10.86	11.32	11.70	12.02	12.28	12.47											
24	10.10	10.66	11.15	11.56	11.91	12.19	12.38	12.49											
25	10.38	10.94	11.43	11.81	12.13	12.35	12.48												
26	10.65	11.19	11.65	12.00	12.28	12.44													
27	10.90	11.41	11.86	12.16	12.38	12.52													
28	11.15	11.63	12.03	12.30	12.47														
29	11.38	11.85	12.20	12.45															
30	11.59	12.03	12.35	12.49															
31	11.76	12.14	12.41																
32	11.92	12.25	12.47																
33	12.08	12.35																	
34	12.20	12.45																	
35	12.30	12.50																	
36	12.40																		
37	12.45																		
38	12.48																		
39	12.50																		

For an arc of contact less than 180° multiply by a correction coefficient as per the following table:

Arc of contact	120°	130°	140°	150°	160°	170°	180°
Coefficient .	.87	.90	.92	.95	.97	.99	1.0

Horse-power Transmitted per Inch of Width by
SINGLE LEATHER BELTS and
CAST-IRON PULLEYS

Diameter of Pulley	REVOLUTIONS PER MINUTE																			
	100	120	140	160	180	200	220	240	260	280	300	325	350	375	400	425	450	475	500	550
3	.11	.12	.13	.15	.17	.19	.20	.22	.24	.26	.28	.31	.33	.35	.88	.40	.42	.45	.47	.52
4	.13	.15	.17	.20	.23	.25	.27	.29	.32	.35	.38	.41	.44	.47	.50	.53	.56	.60	.63	.69
5	.16	.19	.22	.25	.28	.31	.34	.37	.40	.44	.47	.51	.55	.59	.63	.67	.71	.75	.79	.86
6	.19	.22	.26	.30	.34	.37	.41	.45	.49	.53	.57	.61	.66	.71	.75	.79	.84	.89	.94	1.02
7	.22	.26	.31	.35	.40	.44	.48	.53	.57	.62	.66	.71	.76	.81	.86	.92	.97	1.03	1.09	1.19
8	.25	.30	.35	.40	.45	.50	.55	.60	.66	.71	.76	.81	.87	.93	.99	1.05	1.11	1.17	1.23	1.35
9	.28	.34	.40	.45	.51	.57	.62	.68	.74	.80	.85	.91	.97	1.04	1.10	1.17	1.24	1.31	1.38	1.50
10	.31	.37	.43	.50	.57	.63	.69	.75	.82	.88	.94	1.01	1.08	1.15	1.22	1.29	1.36	1.44	1.51	1.65
11	.34	.41	.48	.55	.62	.69	.75	.82	.89	.96	1.03	1.11	1.18	1.27	1.34	1.42	1.50	1.58	1.66	1.81
12	.37	.45	.53	.60	.67	.75	.82	.89	.97	1.04	1.12	1.21	1.29	1.38	1.46	1.54	1.63	1.72	1.80	1.96
13	.40	.49	.57	.65	.73	.81	.88	.96	1.04	1.12	1.21	1.30	1.39	1.48	1.57	1.66	1.76	1.85	1.94	2.11
14	.43	.53	.62	.71	.79	.87	.95	1.03	1.12	1.20	1.29	1.39	1.49	1.59	1.69	1.79	1.89	1.98	2.08	2.26
15	.47	.57	.67	.76	.84	.93	1.01	1.10	1.19	1.28	1.38	1.48	1.58	1.69	1.80	1.90	2.01	2.11	2.21	2.40
16	.50	.60	.70	.80	.89	.98	1.08	1.17	1.27	1.36	1.46	1.57	1.68	1.80	1.91	2.02	2.13	2.24	2.34	2.54
17	.53	.64	.75	.85	.95	1.05	1.15	1.25	1.35	1.45	1.55	1.66	1.78	1.90	2.02	2.14	2.26	2.37	2.47	2.68
18	.56	.68	.79	.89	.99	1.10	1.21	1.31	1.42	1.52	1.63	1.75	1.88	2.00	2.13	2.25	2.37	2.49	2.60	2.81
19	.59	.71	.83	.94	1.05	1.16	1.27	1.38	1.49	1.60	1.71	1.84	1.97	2.10	2.23	2.36	2.48	2.60	2.72	2.94
20	.62	.75	.87	.99	1.11	1.22	1.33	1.45	1.57	1.68	1.80	1.93	2.07	2.20	2.34	2.47	2.60	2.72	2.84	3.06
21	.65	.78	.91	1.04	1.16	1.28	1.40	1.52	1.65	1.76	1.89	2.02	2.17	2.31	2.45	2.58	2.71	2.84	2.96	3.18
22	.68	.82	.95	1.08	1.21	1.34	1.46	1.59	1.73	1.86	1.98	2.12	2.26	2.40	2.55	2.69	2.82	2.95	3.07	3.30
23	.71	.85	.99	1.13	1.26	1.40	1.53	1.66	1.79	1.92	2.06	2.20	2.35	2.50	2.64	2.79	2.92	3.05	3.18	3.41
24	.74	.89	1.03	1.18	1.32	1.45	1.59	1.73	1.87	2.01	2.14	2.29	2.44	2.59	2.74	2.89	3.02	3.15	3.28	3.52
25	.77	.92	1.07	1.22	1.36	1.51	1.65	1.80	1.94	2.08	2.22	2.38	2.53	2.69	2.84	2.99	3.12	3.25	3.38	3.62
26	.80	.96	1.11	1.26	1.41	1.57	1.72	1.87	2.02	2.16	2.30	2.46	2.62	2.78	2.93	3.08	3.22	3.35	3.48	3.71
27	.83	1.00	1.16	1.31	1.47	1.62	1.78	1.94	2.09	2.24	2.37	2.54	2.71	2.87	3.02	3.17	3.31	3.45	3.57	3.79
28	.86	1.03	1.19	1.36	1.52	1.68	1.84	2.00	2.16	2.31	2.45	2.62	2.79	2.95	3.11	3.26	3.41	3.54	3.66	3.86
29	.89	1.06	1.24	1.41	1.57	1.74	1.91	2.07	2.23	2.38	2.52	2.70	2.87	3.04	3.19	3.35	3.50	3.62	3.74	3.93
30	.92	1.09	1.27	1.45	1.62	1.80	1.97	2.13	2.30	2.45	2.60	2.78	2.95	3.12	3.28	3.44	3.58	3.70	3.82	3.99
31	.95	1.13	1.32	1.50	1.68	1.86	2.03	2.20	2.36	2.52	2.67	2.86	3.03	3.20	3.36	3.52	3.66	3.78	3.89	4.05
32	.98	1.17	1.36	1.55	1.74	1.92	2.09	2.26	2.43	2.59	2.75	2.94	3.11	3.28	3.44	3.60	3.73	3.84	3.95	4.10
33	1.01	1.20	1.40	1.59	1.78	1.97	2.15	2.32	2.49	2.66	2.82	3.01	3.19	3.36	3.52	3.67	3.79	3.90	4.00	4.14
34	1.04	1.24	1.44	1.64	1.83	2.03	2.21	2.38	2.56	2.73	2.89	3.08	3.26	3.43	3.59	3.73	3.85	3.95	4.05	4.18
35	1.07	1.27	1.48	1.69	1.89	2.09	2.27	2.44	2.62	2.80	2.96	3.15	3.33	3.50	3.66	3.79	3.91	4.00	4.09	4.20
36	1.10	1.31	1.52	1.73	1.94	2.14	2.33	2.51	2.69	2.87	3.03	3.22	3.40	3.57	3.72	3.85	3.96	4.05	4.13	4.22
37	1.13	1.34	1.56	1.78	1.99	2.20	2.39	2.57	2.75	2.93	3.09	3.29	3.47	3.64	3.78	3.91	4.01	4.09	4.16	4.23
38	1.16	1.38	1.60	1.82	2.04	2.25	2.45	2.63	2.81	2.99	3.16	3.36	3.54	3.70	3.83	3.96	4.06	4.13	4.19	4.22
39	1.19	1.42	1.65	1.87	2.08	2.29	2.50	2.68	2.87	3.05	3.22	3.43	3.60	3.76	3.88	4.00	4.10	4.16	4.21	4.21
40	1.22	1.46	1.69	1.91	2.13	2.35	2.56	2.75	2.93	3.11	3.28	3.49	3.66	3.81	3.93	4.04	4.13	4.19	4.22	4.19
41	1.25	1.49	1.73	1.96	2.18	2.40	2.62	2.81	2.99	3.17	3.34	3.55	3.71	3.86	3.98	4.08	4.16	4.21	4.23	4.16
42	1.28	1.53	1.77	2.00	2.23	2.45	2.67	2.86	3.05	3.23	3.40	3.60	3.76	3.91	4.02	4.12	4.19	4.22	4.22	
43	1.31	1.56	1.81	2.05	2.28	2.50	2.72	2.92	3.11	3.29	3.46	3.66	3.81	3.95	4.06	4.15	4.20	4.23	4.21	
44	1.34	1.60	1.85	2.09	2.33	2.55	2.77	2.97	3.16	3.35	3.52	3.71	3.86	3.99	4.10	4.18	4.22	4.23	4.19	
45	1.36	1.63	1.89	2.13	2.37	2.60	2.82	3.02	3.22	3.41	3.58	3.76	3.91	4.03	4.13	4.20	4.23	4.22	4.16	
46	1.39	1.66	1.93	2.18	2.42	2.65	2.87	3.08	3.28	3.47	3.63	3.80	3.95	4.07	4.16	4.21	4.23	4.20		
47	1.42	1.70	1.97	2.22	2.46	2.70	2.92	3.13	3.33	3.52	3.68	3.85	3.99	4.10	4.18	4.22	4.22	4.17		
48	1.45	1.73	2.01	2.26	2.51	2.74	2.97	3.18	3.38	3.57	3.73	3.89	4.03	4.13	4.20	4.23	4.21	4.14		
49	1.48	1.77	2.05	2.30	2.55	2.79	3.02	3.23	3.43	3.62	3.77	3.93	4.06	4.16	4.21	4.23	4.19			
50	1.51	1.80	2.09	2.35	2.60	2.83	3.07	3.28	3.48	3.66	3.81	3.97	4.09	4.18	4.22	4.22	4.16			
51	1.54	1.83	2.12	2.38	2.64	2.88	3.12	3.33	3.53	3.70	3.85	4.01	4.12	4.19	4.23	4.20				
52	1.57	1.86	2.15	2.42	2.69	2.93	3.17	3.38	3.58	3.74	3.89	4.04	4.14	4.21	4.23	4.18				
53	1.59	1.89	2.19	2.46	2.73	2.97	3.21	3.43	3.63	3.78	3.93	4.07	4.16	4.22	4.22	4.16				
54	1.62	1.93	2.23	2.51	2.78	3.02	3.26	3.47	3.67	3.82	3.96	4.10	4.18	4.23	4.21					
55	1.65	1.97	2.26	2.54	2.82	3.07	3.30	3.52	3.71	3.86	3.99	4.12	4.20	4.23	4.19					
56	1.68	2.00	2.30	2.58	2.86	3.11	3.35	3.56	3.75	3.90	4.02	4.14	4.21	4.22	4.17					
57	1.71	2.03	2.33	2.62	2.90	3.15	3.39	3.61	3.79	3.94	4.05	4.16	4.22	4.22	4.14					
58	1.74	2.07	2.37	2.66	2.94	3.19	3.43	3.65	3.83	3.97	4.08	4.18	4.22	4.20						
59	1.77	2.10	2.41	2.70	2.98	3.23	3.47	3.69	3.86	4.00	4.11	4.20	4.23	4.18						
60	1.80	2.13	2.45	2.74	3.02	3.27	3.51	3.72	3.89	4.03	4.13	4.21	4.22	4.16						

Horse-power Transmitted per Inch of Width by SINGLE LEATHER BELTS and CAST-IRON PULLEYS—*Continued*

Diameter of Pulley	Revolutions per Minute																		
	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
3	.57	.62	.66	.71	.75	.80	.84	.89	.93	1.00	1.08	1.16	1.25	1.34	1.43	1.52	1.61	1.70	1.79
4	.75	.81	.87	.93	.99	1.05	1.11	1.16	1.22	1.33	1.45	1.57	1.68	1.79	1.91	2.02	2.13	2.23	2.33
5	.93	1.00	1.08	1.15	1.22	1.29	1.36	1.43	1.51	1.67	1.82	1.95	2.08	2.21	2.34	2.45	2.58	2.71	2.84
6	1.10	1.19	1.28	1.36	1.45	1.54	1.62	1.70	1.79	1.97	2.13	2.29	2.44	2.59	2.74	2.88	3.02	3.15	3.27
7	1.29	1.39	1.49	1.59	1.69	1.79	1.88	1.97	2.07	2.26	2.44	2.61	2.78	2.94	3.10	3.25	3.40	3.54	3.66
8	1.46	1.57	1.68	1.79	1.90	2.01	2.12	2.23	2.34	2.54	2.73	2.93	3.11	3.28	3.44	3.59	3.72	3.83	3.93
9	1.63	1.75	1.88	2.00	2.12	2.25	2.37	2.48	2.59	2.80	3.01	3.20	3.39	3.57	3.72	3.84	3.96	4.05	4.13
10	1.80	1.94	2.07	2.20	2.33	2.46	2.59	2.71	2.84	3.06	3.27	3.48	3.66	3.81	3.94	4.04	4.13	4.19	4.22
11	1.97	2.12	2.26	2.40	2.54	2.67	2.81	2.94	3.07	3.29	3.51	3.71	3.86	3.99	4.09	4.17	4.22	4.22	4.19
12	2.13	2.29	2.44	2.59	2.74	2.88	2.99	3.13	3.28	3.52	3.70	3.88	4.02	4.13	4.20	4.23	4.21	4.14	
13	2.29	2.46	2.62	2.77	2.93	3.07	3.21	3.34	3.47	3.69	3.89	4.03	4.14	4.21	4.22	4.18			
14	2.45	2.63	2.79	2.95	3.11	3.26	3.38	3.52	3.65	3.86	4.03	4.14	4.21	4.22	4.17				
15	2.59	2.78	2.95	3.12	3.28	3.43	3.56	3.69	3.81	3.99	4.13	4.21	4.22	4.16					
16	2.74	2.94	3.11	3.28	3.44	3.60	3.73	3.83	3.93	4.10	4.20	4.23	4.17						
17	2.88	3.08	3.26	3.43	3.60	3.72	3.84	3.93	4.02	4.17	4.23	4.18							
18	3.02	3.22	3.40	3.57	3.72	3.85	3.96	4.05	4.13	4.22	4.21								
19	3.15	3.35	3.53	3.70	3.83	3.96	4.05	4.12	4.19	4.22	4.14								
20	3.27	3.47	3.65	3.82	3.94	4.05	4.13	4.17	4.22	4.19									
21	3.39	3.58	3.75	3.91	4.03	4.12	4.18	4.21	4.22	4.13									
22	3.50	3.69	3.86	3.99	4.10	4.17	4.22	4.23	4.19										
23	3.60	3.79	3.94	4.06	4.16	4.21	4.23	4.21	4.12										
24	3.70	3.87	4.03	4.13	4.20	4.23	4.21	4.18											
25	3.79	3.95	4.09	4.17	4.22	4.22	4.16												
26	3.87	4.01	4.14	4.21	4.23	4.18													
27	3.95	4.09	4.18	4.22	4.21	4.13													
28	4.02	4.14	4.21	4.22	4.17														
29	4.08	4.18	4.23	4.20															
30	4.13	4.21	4.22	4.16															
31	4.17	4.23	4.20																
32	4.20	4.23	4.17																
33	4.22	4.21																	
34	4.23	4.18																	
35	4.22	4.14																	
36	4.21																		
37	4.18																		
38	4.14																		

For an arc of contact less than 180° multiply by a correction coefficient as per the following table:

Arc of contact	120°	130°	140°	150°	160°	170°	180°
Coefficient.	.79	.83	.87	.91	.94	.97	1.0

Horse-power Transmitted per Inch of Width by DOUBLE LEATHER BELTS and CAST-IRON PULLEYS

Diameter of Pulley	REVOLUTIONS PER MINUTE																			
	100	120	140	160	180	200	220	240	260	280	300	325	350	375	400	425	450	475	500	550
3	.16	.18	.20	.23	.26	.29	.32	.35	.38	.41	.44	.48	.51	.55	.59	.63	.67	.71	.74	.82
4	.19	.23	.27	.31	.35	.39	.43	.47	.51	.55	.59	.64	.69	.74	.79	.84	.89	.94	.98	1.09
5	.24	.29	.34	.39	.44	.49	.54	.59	.64	.69	.74	.80	.87	.93	.99	1.05	1.12	1.18	1.23	1.37
6	.29	.35	.41	.47	.52	.59	.65	.71	.77	.83	.88	.96	1.04	1.12	1.19	1.26	1.34	1.41	1.48	1.63
7	.34	.41	.48	.56	.63	.69	.76	.83	.90	.97	1.03	1.13	1.22	1.31	1.39	1.47	1.56	1.64	1.72	1.90
8	.39	.47	.55	.63	.71	.79	.87	.95	1.03	1.11	1.19	1.29	1.39	1.49	1.58	1.68	1.78	1.87	1.97	2.17
9	.44	.53	.62	.71	.80	.89	.98	1.07	1.16	1.25	1.34	1.45	1.56	1.67	1.78	1.89	2.00	2.10	2.21	2.43
10	.49	.59	.69	.79	.89	.99	1.09	1.19	1.29	1.39	1.49	1.62	1.74	1.86	1.98	2.09	2.21	2.32	2.45	2.68
11	.54	.65	.76	.87	.98	1.09	1.20	1.31	1.42	1.52	1.62	1.78	1.90	2.03	2.16	2.29	2.42	2.55	2.68	2.94
12	.59	.71	.83	.95	1.07	1.19	1.31	1.43	1.55	1.67	1.78	1.93	2.08	2.23	2.37	2.51	2.64	2.77	2.90	3.19
13	.64	.77	.90	1.03	1.16	1.29	1.42	1.55	1.67	1.80	1.92	2.08	2.24	2.40	2.55	2.70	2.84	2.99	3.14	3.43
14	.69	.83	.97	1.11	1.25	1.39	1.53	1.66	1.80	1.94	2.07	2.24	2.41	2.58	2.74	2.89	3.05	3.21	3.36	3.66
15	.74	.89	1.04	1.18	1.34	1.49	1.64	1.78	1.92	2.06	2.20	2.39	2.57	2.74	2.92	3.09	3.26	3.42	3.57	3.89
16	.79	.95	1.11	1.27	1.42	1.58	1.74	1.89	2.05	2.20	2.35	2.55	2.73	2.91	3.10	3.28	3.45	3.62	3.79	4.12
17	.83	1.01	1.18	1.35	1.51	1.68	1.85	2.01	2.18	2.34	2.51	2.70	2.89	3.08	3.29	3.46	3.64	3.81	4.00	4.34
18	.88	1.08	1.26	1.43	1.60	1.78	1.96	2.14	2.31	2.45	2.63	2.85	3.05	3.26	3.46	3.65	3.83	4.01	4.21	4.56
19	.93	1.13	1.32	1.51	1.69	1.87	2.05	2.24	2.43	2.60	2.77	3.00	3.21	3.41	3.62	3.82	4.02	4.21	4.41	4.77
20	.98	1.19	1.39	1.59	1.78	1.97	2.16	2.35	2.54	2.73	2.91	3.14	3.36	3.58	3.80	4.01	4.21	4.41	4.61	4.98
21	1.03	1.25	1.46	1.66	1.87	2.07	2.27	2.46	2.66	2.85	3.05	3.28	3.51	3.73	3.96	4.18	4.40	4.60	4.81	5.18
22	1.08	1.31	1.53	1.74	1.95	2.16	2.37	2.58	2.78	2.98	3.18	3.43	3.66	3.89	4.13	4.36	4.58	4.78	4.98	5.37
23	1.14	1.37	1.59	1.82	2.04	2.26	2.47	2.69	2.90	3.12	3.33	3.57	3.81	4.05	4.29	4.53	4.75	4.96	5.16	5.55
24	1.19	1.43	1.66	1.89	2.12	2.35	2.57	2.80	3.02	3.24	3.45	3.71	3.96	4.21	4.45	4.69	4.92	5.13	5.33	5.72
25	1.24	1.49	1.74	1.97	2.21	2.45	2.68	2.91	3.14	3.36	3.57	3.84	4.11	4.36	4.61	4.85	5.08	5.29	5.50	5.88
26	1.29	1.55	1.80	2.04	2.29	2.54	2.78	3.02	3.26	3.48	3.70	3.98	4.26	4.51	4.76	5.00	5.24	5.45	5.66	6.04
27	1.34	1.60	1.86	2.12	2.38	2.63	2.88	3.13	3.38	3.60	3.82	4.11	4.40	4.66	4.91	5.15	5.39	5.62	5.82	6.19
28	1.39	1.66	1.93	2.20	2.46	2.72	2.98	3.24	3.49	3.72	3.95	4.25	4.54	4.81	5.06	5.30	5.54	5.75	5.96	6.33
29	1.44	1.72	2.00	2.27	2.55	2.82	3.08	3.34	3.60	3.84	4.08	4.38	4.67	4.95	5.20	5.44	5.68	5.89	6.10	6.45
30	1.49	1.77	2.06	2.34	2.63	2.91	3.18	3.45	3.71	3.97	4.21	4.51	4.80	5.08	5.33	5.58	5.82	6.03	6.23	6.55
31	1.53	1.83	2.13	2.42	2.71	3.00	3.28	3.55	3.82	4.08	4.34	4.64	4.93	5.21	5.47	5.72	5.95	6.16	6.35	6.64
32	1.58	1.89	2.20	2.50	2.79	3.08	3.37	3.65	3.93	4.20	4.46	4.77	5.06	5.34	5.59	5.84	6.07	6.28	6.46	6.71
33	1.62	1.95	2.27	2.57	2.88	3.18	3.47	3.75	4.03	4.31	4.57	4.90	5.19	5.46	5.72	5.97	6.19	6.39	6.56	6.76
34	1.68	2.01	2.33	2.65	2.96	3.26	3.57	3.86	4.15	4.42	4.68	5.02	5.32	5.58	5.84	6.09	6.31	6.50	6.63	6.81
35	1.73	2.06	2.39	2.70	3.10	3.38	3.66	3.96	4.26	4.53	4.79	5.13	5.42	5.70	5.96	6.20	6.42	6.58	6.69	6.84
36	1.78	2.12	2.45	2.79	3.15	3.45	3.75	4.05	4.35	4.64	4.90	5.24	5.53	5.82	6.07	6.31	6.51	6.64	6.75	6.85
37	1.82	2.18	2.52	2.87	3.22	3.54	3.85	4.15	4.45	4.75	5.01	5.35	5.64	5.92	6.17	6.41	6.58	6.70	6.79	6.86
38	1.87	2.24	2.60	2.95	3.29	3.63	3.94	4.25	4.56	4.86	5.12	5.45	5.75	6.03	6.27	6.50	6.64	6.75	6.82	6.84
39	1.92	2.30	2.67	3.02	3.37	3.70	4.03	4.35	4.66	4.96	5.23	5.56	5.86	6.13	6.37	6.57	6.70	6.79	6.85	6.82
40	1.97	2.35	2.73	3.09	3.45	3.79	4.12	4.45	4.76	5.06	5.34	5.66	5.96	6.23	6.46	6.63	6.75	6.82	6.86	6.78
41	2.02	2.41	2.79	3.16	3.53	3.88	4.22	4.55	4.86	5.16	5.45	5.76	6.05	6.32	6.54	6.68	6.79	6.84	6.85	6.73
42	2.07	2.46	2.85	3.24	3.60	3.96	4.31	4.64	4.96	5.26	5.55	5.86	6.14	6.41	6.60	6.73	6.82	6.85	6.83	
43	2.12	2.52	2.92	3.31	3.68	4.04	4.40	4.74	5.06	5.36	5.64	5.96	6.23	6.48	6.66	6.77	6.84	6.86	6.81	
44	2.16	2.58	2.98	3.38	3.76	4.13	4.50	4.83	5.15	5.45	5.73	6.05	6.32	6.55	6.71	6.81	6.85	6.84	6.78	
45	2.21	2.63	3.05	3.44	3.83	4.20	4.56	4.91	5.24	5.54	5.81	6.14	6.41	6.61	6.75	6.83	6.86	6.82	6.73	
46	2.26	2.69	3.12	3.51	3.90	4.29	4.66	5.00	5.33	5.63	5.90	6.22	6.48	6.66	6.79	6.85	6.85	6.79		
47	2.30	2.74	3.18	3.58	3.98	4.37	4.74	5.08	5.41	5.72	5.99	6.30	6.55	6.71	6.81	6.86	6.83	6.75		
48	2.35	2.80	3.24	3.65	4.05	4.45	4.82	5.17	5.50	5.80	6.07	6.38	6.60	6.75	6.83	6.86	6.81	6.70		
49	2.40	2.85	3.30	3.72	4.13	4.53	4.90	5.26	5.58	5.88	6.15	6.45	6.65	6.78	6.85	6.84	6.77			
50	2.45	2.91	3.36	3.78	4.20	4.61	4.98	5.34	5.66	5.96	6.23	6.52	6.69	6.81	6.86	6.83	6.73			
51	2.50	2.96	3.42	3.85	4.28	4.69	5.06	5.42	5.74	6.04	6.31	6.57	6.73	6.83	6.86	6.80				
52	2.54	3.02	3.48	3.92	4.35	4.76	5.14	5.50	5.82	6.11	6.38	6.62	6.77	6.84	6.85	6.77				
53	2.58	3.07	3.54	3.99	4.43	4.84	5.22	5.58	5.90	6.19	6.44	6.66	6.80	6.85	6.83	6.73				
54	2.63	3.13	3.60	4.06	4.50	4.92	5.30	5.65	5.97	6.26	6.50	6.70	6.82	6.86	6.81					
55	2.68	3.18	3.66	4.13	4.58	4.99	5.38	5.73	6.04	6.33	6.56	6.74	6.84	6.85	6.78					
56	2.73	3.24	3.72	4.20	4.64	5.06	5.45	5.80	6.11	6.40	6.60	6.77	6.85	6.84	6.74					
57	2.77	3.29	3.78	4.26	4.71	5.13	5.52	5.87	6.18	6.46	6.64	6.80	6.85	6.82	6.70					
58	2.82	3.35	8.84	4.32	4.77	5.20	5.59	5.94	6.25	6.52	6.68	6.82	6.85	6.80						
59	2.87	3.40	3.91	4.38	4.83	5.25	5.66	6.01	6.32	6.56	6.72	6.83	6.85	6.77						
60	2.91	3.45	3.97	4.45	4.91	5.29	5.68	6.06	6.35	6.60	6.75	6.84	6.84	6.73						

Horse-power Transmitted per Inch of Width by DOUBLE LEATHER BELTS and CAST-IRON PULLEYS—*Continued*

Diameter of Pulley	REVOLUTIONS PER MINUTE																		
	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
3	.90	.99	1.07	1.14	1.20	1.27	1.34	1.41	1.48	1.62	1.78	1.92	2.07	2.21	2.36	2.50	2.63	2.79	2.91
4	1.20	1.30	1.40	1.49	1.58	1.68	1.78	1.87	1.97	2.16	2.35	2.54	2.73	2.91	3.09	3.27	3.45	3.62	3.78
5	1.49	1.61	1.73	1.85	1.97	2.09	2.21	2.33	2.45	2.68	2.91	3.14	3.36	3.57	3.78	3.99	4.20	4.41	4.60
6	1.78	1.92	2.07	2.22	2.36	2.50	2.63	2.76	2.90	3.19	3.45	3.71	3.95	4.19	4.44	4.68	4.90	5.12	5.33
7	2.07	2.23	2.40	2.57	2.73	2.89	3.05	3.21	3.37	3.66	3.95	4.24	4.52	4.79	5.05	5.29	5.54	5.75	5.95
8	2.36	2.54	2.72	2.90	3.08	3.26	3.44	3.61	3.78	4.12	4.45	4.77	5.06	5.34	5.60	5.84	6.06	6.27	6.45
9	2.64	2.84	3.04	3.24	3.44	3.64	3.83	4.01	4.19	4.56	4.91	5.24	5.53	5.81	6.07	6.29	6.50	6.63	6.74
10	2.92	3.14	3.35	3.56	3.80	4.00	4.21	4.41	4.61	4.98	5.34	5.66	5.95	6.23	6.46	6.62	6.75	6.82	6.85
11	3.19	3.43	3.66	3.89	4.12	4.36	4.57	4.78	4.98	5.37	5.72	6.05	6.32	6.55	6.70	6.80	6.85	6.84	6.78
12	3.45	3.71	3.95	4.19	4.45	4.68	4.92	5.13	5.33	5.72	6.08	6.38	6.60	6.75	6.83	6.85	6.81	6.75	
13	3.71	3.99	4.25	4.51	4.77	5.00	5.23	5.45	5.65	6.04	6.38	6.61	6.76	6.84	6.85	6.77			
14	3.96	4.26	4.53	4.80	5.05	5.30	5.54	5.71	5.96	6.13	6.52	6.77	6.85	6.84	6.75				
15	4.21	4.52	4.80	5.08	5.33	5.58	5.82	6.03	6.23	6.56	6.75	6.84	6.84	6.74					
16	4.45	4.77	5.05	5.33	5.59	5.85	6.07	6.28	6.45	6.70	6.83	6.85	6.75						
17	4.68	5.01	5.30	5.58	5.84	6.09	6.30	6.50	6.60	6.80	6.86	6.77							
18	4.91	5.24	5.53	5.81	6.07	6.30	6.50	6.64	6.75	6.85	6.80								
19	5.13	5.46	5.75	6.03	6.28	6.50	6.64	6.74	6.82	6.84	6.70								
20	5.34	5.67	5.96	6.22	6.47	6.63	6.75	6.81	6.86	6.78									
21	5.54	5.86	6.15	6.40	6.60	6.73	6.82	6.84	6.84	6.69									
22	5.73	6.04	6.32	6.55	6.71	6.81	6.85	6.85	6.78										
23	5.92	6.21	6.49	6.66	6.78	6.85	6.85	6.80	6.68										
24	6.08	6.38	6.60	6.75	6.83	6.85	6.81	6.74											
25	6.23	6.52	6.69	6.81	6.86	6.83	6.74												
26	6.37	6.62	6.77	6.84	6.85	6.77													
27	6.50	6.70	6.82	6.86	6.80	6.69													
28	6.63	6.77	6.85	6.84	6.74														
29	6.69	6.82	6.86	6.80															
30	6.75	6.85	6.84	6.73															
31	6.80	6.86	6.80																
32	6.84	6.85	6.74																
33	6.85	6.82																	
34	6.86	6.77																	
35	6.84	6.70																	
36	6.81																		
37	6.76																		
38	6.70																		

For an arc of contact less than 180° multiply by a correction coefficient as per the following table :

Arc of contact	120°	130°	140°	150°	160°	170°	180°
Coefficient	.79	.83	.87	.91	.94	.97	1.0

Horse-power Transmitted per Inch of Width by SINGLE LEATHER BELTS and WOOD PULLEYS

Diameter of Pulley	REVOLUTIONS PER MINUTE																			
	100	120	140	160	180	200	220	240	260	280	300	325	350	375	400	425	450	475	500	550
3	.06	.07	.08	.09	.10	.12	.13	.14	.15	.16	.18	.19	.21	.23	.24	.25	.27	.29	.30	.33
4	.08	.10	.11	.13	.14	.16	.18	.19	.21	.23	.25	.27	.28	.30	.32	.34	.36	.38	.40	.44
5	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30	.33	.36	.38	.40	.43	.46	.48	.51	.56
6	.12	.15	.17	.20	.22	.25	.27	.29	.31	.34	.37	.40	.43	.46	.49	.52	.55	.58	.61	.67
7	.14	.17	.20	.23	.26	.29	.32	.35	.37	.40	.43	.46	.50	.53	.56	.60	.64	.67	.70	.77
8	.16	.20	.23	.26	.29	.32	.36	.39	.42	.46	.49	.53	.57	.61	.65	.69	.73	.77	.81	.88
9	.18	.22	.25	.29	.33	.36	.40	.44	.47	.51	.54	.59	.63	.68	.73	.77	.81	.86	.91	.99
10	.20	.24	.28	.32	.36	.40	.45	.49	.53	.57	.61	.66	.71	.76	.81	.86	.91	.96	1.01	1.10
11	.22	.27	.32	.36	.41	.45	.49	.53	.57	.63	.67	.73	.78	.83	.89	.95	1.00	1.05	1.11	1.21
12	.24	.29	.34	.39	.44	.49	.54	.59	.64	.69	.73	.80	.86	.91	.97	1.03	1.09	1.15	1.20	1.31
13	.26	.32	.37	.42	.48	.53	.58	.63	.68	.74	.79	.86	.92	.98	1.05	1.12	1.18	1.24	1.30	1.42
14	.28	.34	.40	.45	.51	.57	.62	.68	.73	.79	.85	.92	.99	1.06	1.13	1.20	1.26	1.33	1.39	1.52
15	.30	.36	.42	.48	.54	.60	.66	.72	.78	.84	.90	.97	1.05	1.12	1.20	1.27	1.34	1.41	1.48	1.62
16	.32	.39	.45	.51	.58	.64	.70	.77	.83	.90	.96	1.04	1.12	1.20	1.27	1.35	1.42	1.49	1.57	1.72
17	.34	.41	.48	.55	.62	.68	.75	.82	.89	.95	1.02	1.10	1.19	1.27	1.35	1.43	1.50	1.57	1.65	1.82
18	.36	.44	.51	.58	.65	.72	.80	.87	.94	1.00	1.08	1.16	1.25	1.33	1.42	1.50	1.58	1.66	1.74	1.89
19	.38	.46	.54	.61	.69	.77	.85	.92	1.00	1.07	1.14	1.22	1.32	1.41	1.50	1.59	1.67	1.77	1.82	1.96
20	.41	.49	.58	.65	.74	.82	.90	.97	1.05	1.12	1.20	1.29	1.39	1.48	1.56	1.64	1.73	1.81	1.89	2.03
21	.43	.51	.60	.68	.76	.85	.94	1.02	1.10	1.18	1.26	1.36	1.46	1.55	1.64	1.72	1.80	1.88	1.96	2.10
22	.45	.54	.63	.72	.81	.90	.98	1.07	1.15	1.23	1.31	1.42	1.52	1.60	1.69	1.78	1.87	1.96	2.03	2.17
23	.47	.56	.66	.75	.84	.94	1.03	1.12	1.21	1.29	1.38	1.48	1.58	1.67	1.76	1.85	1.94	2.02	2.10	2.24
24	.49	.58	.68	.78	.88	.98	1.07	1.16	1.25	1.34	1.42	1.53	1.63	1.72	1.82	1.92	2.01	2.09	2.16	2.30
25	.51	.60	.71	.81	.91	1.01	1.11	1.21	1.30	1.39	1.48	1.58	1.68	1.78	1.88	1.97	2.06	2.15	2.22	2.36
26	.53	.63	.73	.84	.95	1.05	1.15	1.24	1.34	1.43	1.52	1.63	1.74	1.84	1.94	2.04	2.12	2.20	2.28	2.42
27	.55	.66	.77	.88	.99	1.10	1.20	1.30	1.40	1.50	1.58	1.69	1.80	1.90	2.00	2.09	2.18	2.26	2.34	2.46
28	.57	.69	.80	.91	1.03	1.14	1.24	1.34	1.44	1.54	1.63	1.75	1.85	1.96	2.06	2.15	2.24	2.32	2.39	2.50
29	.59	.71	.82	.94	1.06	1.18	1.28	1.38	1.48	1.58	1.68	1.79	1.90	2.00	2.11	2.20	2.29	2.36	2.43	2.53
30	.61	.73	.85	.97	1.09	1.21	1.32	1.42	1.53	1.63	1.73	1.85	1.96	2.06	2.16	2.25	2.33	2.40	2.47	2.57
31	.63	.75	.88	1.00	1.12	1.24	1.36	1.47	1.57	1.68	1.78	1.89	2.00	2.11	2.21	2.30	2.38	2.45	2.51	2.60
32	.65	.78	.91	1.03	1.16	1.28	1.39	1.50	1.61	1.72	1.82	1.93	2.05	2.16	2.26	2.35	2.42	2.49	2.54	2.62
33	.67	.80	.94	1.07	1.20	1.32	1.45	1.56	1.66	1.77	1.88	1.98	2.09	2.19	2.30	2.40	2.46	2.52	2.57	2.64
34	.69	.83	.96	1.10	1.22	1.35	1.48	1.59	1.70	1.81	1.92	2.02	2.14	2.24	2.34	2.43	2.50	2.56	2.60	2.65
35	.71	.85	.99	1.12	1.25	1.38	1.50	1.63	1.73	1.84	1.95	2.08	2.19	2.29	2.38	2.46	2.53	2.58	2.53	2.66
36	.73	.88	1.02	1.15	1.29	1.42	1.54	1.66	1.77	1.88	1.99	2.12	2.23	2.33	2.42	2.50	2.56	2.60	2.64	2.65
37	.75	.91	1.05	1.19	1.33	1.46	1.58	1.71	1.82	1.93	2.04	2.16	2.27	2.37	2.45	2.53	2.58	2.62	2.65	2.65
38	.77	.93	1.08	1.22	1.36	1.50	1.62	1.75	1.86	1.98	2.08	2.20	2.31	2.40	2.48	2.56	2.60	2.64	2.66	2.63
39	.79	.95	1.10	1.24	1.38	1.52	1.65	1.78	1.90	2.01	2.10	2.23	2.35	2.44	2.52	2.58	2.62	2.65	2.65	2.60
40	.81	.97	1.12	1.27	1.41	1.55	1.68	1.81	1.94	2.05	2.15	2.27	2.38	2.47	2.55	2.60	2.64	2.66	2.64	2.56
41	.83	1.00	1.15	1.30	1.45	1.59	1.72	1.85	1.97	2.09	2.19	2.30	2.42	2.50	2.57	2.61	2.65	2.66	2.64	2.52
42	.85	1.02	1.18	1.34	1.49	1.63	1.76	1.89	2.02	2.13	2.23	2.33	2.44	2.52	2.58	2.63	2.66	2.65	2.53	
43	.87	1.04	1.21	1.37	1.53	1.67	1.80	1.93	2.06	2.16	2.26	2.36	2.46	2.55	2.61	2.54	2.67	2.64	2.60	
44	.89	1.06	1.23	1.40	1.55	1.70	1.83	1.96	2.09	2.20	2.30	2.40	2.49	2.58	2.53	2.65	2.66	2.62	2.57	
45	.91	1.08	1.26	1.42	1.58	1.73	1.87	2.00	2.12	2.23	2.34	2.45	2.53	2.60	2.64	2.67	2.65	2.60	2.52	
46	.93	1.11	1.28	1.45	1.61	1.76	1.90	2.03	2.16	2.27	2.37	2.47	2.56	2.62	2.64	2.66	2.63	2.57		
47	.95	1.13	1.31	1.48	1.64	1.79	1.93	2.06	2.19	2.29	2.39	2.50	2.57	2.62	2.64	2.65	2.61	2.54		
48	.97	1.16	1.34	1.51	1.67	1.82	1.96	2.10	2.22	2.33	2.42	2.52	2.59	2.63	2.65	2.65	2.59	2.51		
49	.99	1.19	1.36	1.53	1.70	1.85	2.00	2.13	2.25	2.36	2.45	2.54	2.60	2.63	2.65	2.63	2.56			
50	1.01	1.21	1.39	1.56	1.73	1.88	2.03	2.16	2.28	2.38	2.47	2.56	2.62	2.64	2.65	2.61	2.52			
51	1.03	1.23	1.41	1.59	1.75	1.91	2.06	2.19	2.31	2.41	2.49	2.57	2.63	2.64	2.64	2.59				
52	1.05	1.25	1.44	1.61	1.78	1.94	2.09	2.22	2.34	2.44	2.52	2.59	2.64	2.65	2.63	2.56				
53	1.07	1.27	1.46	1.64	1.81	1.97	2.12	2.25	2.37	2.46	2.54	2.61	2.64	2.65	2.62	2.53				
54	1.09	1.80	1.49	1.67	1.84	2.00	2.15	2.27	2.39	2.48	2.55	2.62	2.65	2.64	2.58					
55	1.11	1.32	1.51	1.69	1.86	2.03	2.18	2.30	2.41	2.51	2.57	2.63	2.65	2.64	2.56					
56	1.12	1.34	1.53	1.72	1.89	2.05	2.20	2.33	2.44	2.53	2.58	2.63	2.65	2.62	2.53					
57	1.14	1.36	1.56	1.75	1.92	2.08	2.22	2.35	2.46	2.55	2.60	2.64	2.65	2.61	2.51					
58	1.16	1.38	1.58	1.77	1.95	2.11	2.25	2.38	2.48	2.56	2.62	2.64	2.64	2.59						
59	1.18	1.40	1.60	1.79	1.97	2.13	2.28	2.40	2.50	2.57	2.62	2.65	2.63	2.56						
60	1.20	1.42	1.68	1.82	2.00	2.16	2.30	2.42	2.52	2.59	2.63	2.65	2.62	2.53						

Horse-power Transmitted per Inch of Width by SINGLE LEATHER BELTS and WOOD PULLEYS—*Continued*

Diameter of Pulley	REVOLUTIONS PER MINUTE																		
	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
3	.36	.40	.43	.46	.49	.52	.55	.58	.61	.66	.73	.79	.85	.91	.97	1.03	1.09	1.15	1.21
4	.48	.52	.56	.61	.65	.69	.73	.77	.81	.89	.97	1.05	1.13	1.20	1.28	1.36	1.44	1.50	1.55
5	.61	.66	.71	.76	.81	.86	.91	.96	1.01	1.12	1.21	1.30	1.39	1.48	1.57	1.65	1.73	1.80	1.87
6	.73	.79	.85	.91	.97	1.03	1.09	1.15	1.20	1.32	1.43	1.53	1.63	1.73	1.83	1.92	2.00	2.08	2.16
7	.85	.91	.98	1.05	1.12	1.19	1.25	1.32	1.38	1.51	1.63	1.74	1.85	1.96	2.06	2.15	2.24	2.32	2.38
8	.96	1.04	1.12	1.20	1.28	1.35	1.42	1.49	1.56	1.70	1.82	1.93	2.04	2.15	2.25	2.34	2.42	2.48	2.54
9	1.08	1.16	1.25	1.34	1.42	1.50	1.58	1.66	1.73	1.88	2.00	2.12	2.23	2.32	2.41	2.49	2.55	2.60	2.63
10	1.20	1.29	1.39	1.48	1.56	1.65	1.73	1.81	1.89	2.03	2.16	2.28	2.38	2.48	2.54	2.60	2.64	2.66	2.65
11	1.32	1.42	1.52	1.61	1.70	1.80	1.88	1.96	2.04	2.18	2.30	2.40	2.50	2.57	2.63	2.64	2.65	2.62	2.57
12	1.42	1.53	1.64	1.74	1.83	1.92	2.00	2.08	2.16	2.30	2.42	2.51	2.58	2.63	2.65	2.64	2.58	2.50	
13	1.53	1.64	1.75	1.85	1.94	2.03	2.12	2.20	2.27	2.41	2.51	2.58	2.63	2.65	2.65	2.56			
14	1.64	1.75	1.86	1.97	2.06	2.15	2.24	2.32	2.41	2.50	2.58	2.63	2.65	2.63	2.53				
15	1.74	1.86	1.97	2.07	2.17	2.26	2.34	2.41	2.47	2.57	2.63	2.65	2.61	2.54					
16	1.84	1.96	2.07	2.16	2.25	2.35	2.43	2.49	2.54	2.62	2.64	2.63							
17	1.94	2.06	2.17	2.26	2.35	2.43	2.49	2.54	2.59	2.65	2.64	2.56							
18	2.02	2.13	2.24	2.34	2.42	2.50	2.56	2.60	2.63	2.65	2.58								
19	2.09	2.20	2.31	2.41	2.48	2.55	2.61	2.63	2.65	2.63	2.51								
20	2.17	2.28	2.38	2.47	2.54	2.60	2.64	2.65	2.64	2.59									
21	2.23	2.35	2.45	2.54	2.59	2.63	2.65	2.64	2.63	2.55									
22	2.29	2.41	2.51	2.58	2.62	2.64	2.65	2.62	2.57										
23	2.36	2.47	2.55	2.60	2.64	2.65	2.64	2.60	2.50										
24	2.42	2.52	2.58	2.63	2.66	2.64	2.61	2.55											
25	2.48	2.56	2.61	2.64	2.65	2.62	2.55												
26	2.53	2.60	2.63	2.64	2.62	2.56													
27	2.56	2.62	2.65	2.64	2.58	2.50													
28	2.59	2.64	2.66	2.63	2.53														
29	2.62	2.65	2.65	2.58															
30	2.64	2.66	2.63	2.53															
31	2.65	2.65	2.59																
32	2.65	2.63	2.53																
33	2.65	2.61																	
34	2.65	2.57																	
35	2.62	2.51																	
36	2.59																		
37	2.55																		
38	2.51																		

The horse-power transmitted by pulp pulleys is 9 per cent. less than that given in the tables for wood pulleys.

For an arc of contact less than 180° multiply by a correction coefficient as per the following table :

Arc of contact	120°	130°	140°	150°	160°	170°	180°
Coefficient .	.76	.80	.84	.88	.93	.97	1.0

Horse-power Transmitted per Inch of Width by DOUBLE LEATHER BELTS and WOOD PULLEYS

Diameter of Pulley	Revolutions per Minute																			
	100	120	140	160	180	200	220	240	260	280	300	325	350	375	400	425	450	475	500	550
3	.10	.12	.14	.16	.17	.19	.21	.23	.25	.27	.29	.32	.34	.37	.39	.42	.44	.47	.49	.54
4	.13	.16	.19	.21	.24	.26	.29	.32	.35	.37	.39	.43	.46	.49	.53	.56	.59	.62	.66	.72
5	.16	.20	.23	.26	.29	.33	.36	.39	.43	.46	.49	.53	.58	.62	.66	.70	.74	.78	.82	.90
6	.20	.24	.28	.32	.36	.40	.44	.47	.51	.55	.59	.64	.69	.74	.79	.84	.89	.94	.99	1.08
7	.23	.28	.32	.36	.41	.46	.50	.55	.59	.64	.69	.74	.80	.86	.92	.98	1.04	1.10	1.15	1.25
8	.26	.31	.36	.41	.47	.53	.58	.64	.69	.74	.79	.85	.91	.98	1.05	1.12	1.19	1.26	1.33	1.44
9	.29	.35	.41	.46	.52	.58	.64	.71	.77	.83	.89	.95	1.02	1.10	1.18	1.25	1.33	1.41	1.48	1.61
10	.32	.39	.46	.52	.59	.65	.72	.79	.85	.92	.99	1.07	1.14	1.22	1.31	1.39	1.48	1.56	1.84	1.79
11	.36	.43	.50	.58	.65	.72	.79	.86	.93	1.00	1.07	1.16	1.26	1.35	1.44	1.53	1.62	1.71	1.80	1.98
12	.39	.47	.55	.63	.71	.79	.87	.94	1.02	1.10	1.18	1.28	1.38	1.48	1.57	1.67	1.76	1.85	1.95	2.14
13	.43	.51	.60	.68	.77	.85	.94	1.02	1.11	1.20	1.28	1.38	1.49	1.60	1.70	1.80	1.91	2.01	2.11	2.30
14	.46	.55	.64	.73	.82	.91	1.00	1.09	1.19	1.29	1.38	1.48	1.60	1.72	1.83	1.93	2.04	2.15	2.26	2.45
15	.49	.59	.68	.78	.88	.98	1.08	1.17	1.27	1.37	1.47	1.59	1.72	1.84	1.95	2.07	2.18	2.29	2.40	2.60
16	.52	.63	.73	.83	.93	1.04	1.14	1.24	1.35	1.45	1.55	1.68	1.81	1.94	2.07	2.20	2.31	2.40	2.52	2.73
17	.55	.67	.78	.89	.99	1.10	1.22	1.33	1.44	1.55	1.65	1.78	1.92	2.05	2.19	2.33	2.45	2.56	2.66	2.88
18	.59	.71	.83	.95	1.06	1.18	1.30	1.41	1.52	1.64	1.75	1.90	2.05	2.18	2.32	2.45	2.56	2.68	2.80	3.03
19	.63	.76	.89	1.01	1.14	1.26	1.38	1.49	1.61	1.74	1.87	2.01	2.15	2.29	2.43	2.56	2.68	2.80	2.93	3.16
20	.67	.81	.94	1.07	1.20	1.33	1.46	1.58	1.70	1.83	1.95	2.10	2.25	2.40	2.54	2.68	2.80	2.93	3.05	3.29
21	.71	.85	.99	1.12	1.26	1.39	1.52	1.64	1.78	1.91	2.03	2.20	2.35	2.50	2.64	2.78	2.92	3.05	3.17	3.40
22	.75	.90	1.04	1.18	1.33	1.47	1.60	1.73	1.87	2.00	2.13	2.28	2.44	2.60	2.74	2.88	3.02	3.16	3.29	3.51
23	.78	.94	1.09	1.24	1.39	1.54	1.69	1.82	1.95	2.09	2.21	2.38	2.54	2.70	2.85	2.99	3.14	3.27	3.40	3.62
24	.82	.98	1.13	1.28	1.44	1.59	1.74	1.88	2.03	2.18	2.31	2.47	2.63	2.79	2.95	3.10	3.24	3.38	3.50	3.73
25	.84	1.01	1.17	1.33	1.49	1.66	1.82	1.97	2.12	2.27	2.40	2.56	2.72	2.89	3.05	3.20	3.33	3.47	3.58	3.83
26	.86	1.04	1.22	1.38	1.55	1.71	1.88	2.04	2.20	2.36	2.49	2.65	2.81	2.97	3.13	3.29	3.43	3.56	3.67	3.92
27	.89	1.08	1.26	1.43	1.60	1.77	1.95	2.13	2.29	2.44	2.56	2.74	2.91	3.07	3.24	3.39	3.53	3.65	3.76	3.98
28	.93	1.12	1.30	1.49	1.66	1.85	2.03	2.21	2.36	2.52	2.64	2.81	3.00	3.17	3.33	3.48	3.62	3.74	3.86	4.05
29	.96	1.16	1.35	1.54	1.71	1.89	2.08	2.24	2.41	2.59	2.73	2.90	3.08	3.25	3.42	3.57	3.71	3.83	3.95	4.11
30	1.00	1.20	1.40	1.59	1.77	1.95	2.14	2.31	2.47	2.64	2.80	2.98	3.16	3.33	3.50	3.65	3.78	3.89	4.00	4.17
31	1.04	1.23	1.43	1.63	1.82	2.00	2.18	2.37	2.53	2.74	2.87	3.07	3.25	3.42	3.59	3.72	3.85	3.96	4.06	4.21
32	1.07	1.27	1.48	1.68	1.88	2.06	2.24	2.44	2.61	2.80	2.95	3.15	3.34	3.50	3.66	3.79	3.91	4.02	4.12	4.25
33	1.09	1.30	1.52	1.72	1.93	2.12	2.31	2.51	2.68	2.86	3.03	3.23	3.40	3.57	3.73	3.86	3.98	4.08	4.18	4.28
34	1.12	1.34	1.56	1.77	1.98	2.18	2.38	2.58	2.76	2.94	3.10	3.30	3.45	3.63	3.80	3.92	4.04	4.15	4.24	4.28
35	1.15	1.38	1.60	1.82	2.03	2.23	2.42	2.62	2.81	3.02	3.18	3.38	3.55	3.70	3.86	3.98	4.10	4.22	4.30	4.31
36	1.18	1.43	1.65	1.87	2.09	2.29	2.48	2.70	2.87	3.06	3.24	3.44	3.61	3.77	3.92	4.05	4.15	4.24	4.33	4.30
37	1.21	1.46	1.70	1.91	2.15	2.36	2.55	2.75	2.94	3.14	3.30	3.50	3.68	3.84	3.97	4.10	4.18	4.25	4.33	4.28
38	1.25	1.51	1.74	1.97	2.20	2.42	2.62	2.82	3.01	3.20	3.37	3.56	3.75	3.89	4.02	4.15	4.22	4.28	4.32	4.26
39	1.28	1.54	1.78	2.01	2.24	2.47	2.68	2.89	3.08	3.26	3.43	3.62	3.80	3.94	4.08	4.19	4.25	4.30	4.30	4.22
40	1.31	1.57	1.82	2.06	2.29	2.53	2.73	2.94	3.14	3.32	3.48	3.68	3.86	4.00	4.13	4.22	4.28	4.31	4.29	4.15
41	1.35	1.61	1.86	2.11	2.35	2.58	2.79	3.00	3.21	3.38	3.55	3.73	3.90	4.03	4.17	4.24	4.30	4.32	4.28	4.08
42	1.38	1.65	1.91	2.17	2.41	2.64	2.85	3.06	3.27	3.45	3.61	3.78	3.95	4.08	4.20	4.27	4.32	4.30	4.26	
43	1.41	1.68	1.95	2.22	2.48	2.70	2.92	3.13	3.33	3.49	3.67	3.83	3.99	4.13	4.23	4.29	4.33	4.28	4.22	
44	1.44	1.72	1.99	2.26	2.51	2.75	2.97	3.18	3.39	3.56	3.73	3.89	4.04	4.18	4.26	4.31	4.32	4.24	4.17	
45	1.47	1.76	2.04	2.32	2.56	2.80	3.03	3.24	3.44	3.62	3.79	3.95	4.10	4.22	4.27	4.33	4.30	4.22	4.08	
46	1.51	1.80	2.08	2.36	2.61	2.85	3.08	3.29	3.50	3.67	3.83	4.00	4.15	4.23	4.28	4.31	4.27	4.17		
47	1.54	1.84	2.12	2.40	2.66	2.90	3.13	3.34	3.55	3.72	3.87	4.05	4.17	4.25	4.29	4.30	4.23	4.12		
48	1.57	1.88	2.17	2.44	2.70	2.95	3.18	3.40	3.60	3.78	3.92	4.08	4.20	4.27	4.30	4.29	4.19	4.08		
49	1.61	1.92	2.22	2.48	2.75	3.00	3.24	3.45	3.65	3.83	3.97	4.12	4.22	4.27	4.31	4.27	4.15			
50	1.64	1.96	2.25	2.53	2.80	3.05	3.29	3.50	3.70	3.87	4.00	4.15	4.25	4.29	4.30	4.24	4.08			
51	1.67	1.99	2.29	2.58	2.84	3.10	3.34	3.55	3.75	3.91	4.03	4.17	4.27	4.29	4.29	4.20				
52	1.70	2.03	2.33	2.61	2.89	3.15	3.39	3.60	3.79	3.96	4.08	4.20	4.29	4.30	4.27	4.15				
53	1.74	2.07	2.37	2.65	2.93	3.19	3.44	3.64	3.84	3.99	4.12	4.23	4.29	4.30	4.24	4.10				
54	1.77	2.11	2.41	2.69	2.97	3.24	3.49	3.69	3.88	4.02	4.14	4.25	4.30	4.29	4.20					
55	1.80	2.14	2.45	2.74	3.02	3.29	3.54	3.73	3.91	4.06	4.16	4.27	4.30	4.27	4.15					
56	1.82	2.17	2.49	2.79	3.06	3.33	3.58	3.78	3.96	4.10	4.18	4.28	4.30	4.25	4.11					
57	1.85	2.20	2.53	2.84	3.13	3.38	3.62	3.83	3.99	4.13	4.21	4.29	4.80	4.23	4.07					
58	1.88	2.24	2.56	2.87	3.16	3.42	3.66	3.86	4.02	4.15	4.24	4.30	4.29	4.20						
59	1.91	2.27	2.60	2.91	3.20	3.46	3.70	3.89	4.05	4.17	4.25	4.31	4.27	4.15						
60	1.95	2.30	2.64	2.95	3.24	3.50	3.73	3.92	4.08	4.20	4.26	4.31	4.25	4.10						

Horse-power Transmitted per Inch of Width by DOUBLE LEATHER BELTS and WOOD PULLEYS—*Continued*

Diameter of Pulley	REVOLUTIONS PER MINUTE																		
	600	**650**	**700**	**750**	**800**	**850**	**900**	**950**	**1000**	**1100**	**1200**	**1300**	**1400**	**1500**	**1600**	**1700**	**1800**	**1900**	**2000**
3	.59	.64	.69	.74	.79	.84	.89	.94	.99	1.09	1.19	1.29	1.39	1.48	1.58	1.68	1.78	1.87	1.96
4	.78	.84	.91	.98	1.05	1.12	1.18	1.25	1.32	1.46	1.59	1.70	1.83	1.97	2.07	2.22	2.32	2.41	2.52
5	.98	1.05	1.14	1.23	1.31	1.40	1.48	1.56	1.64	1.82	1.97	2.11	2.26	2.40	2.53	2.63	2.80	2.94	3.05
6	1.18	1.28	1.38	1.48	1.57	1.67	1.77	1.86	1.95	2.14	2.31	2.48	2.65	2.80	2.95	3.08	3.29	3.36	3.50
7	1.37	1.48	1.60	1.72	1.83	1.93	2.04	2.15	2.26	2.45	2.63	2.82	2.99	3.17	3.33	3.51	3.62	3.74	3.86
8	1.55	1.67	1.81	1.95	2.07	2.19	2.31	2.41	2.52	2.74	2.93	3.14	3.31	3.48	3.66	3.78	3.91	4.03	4.12
9	1.74	1.89	2.03	2.17	2.30	2.43	2.56	2.67	2.80	3.03	3.23	3.44	3.62	3.78	3.94	4.04	4.13	4.23	4.34
10	1.94	2.11	2.26	2.40	2.53	2.67	2.81	2.94	3.05	3.30	3.48	3.69	3.87	3.99	4.14	4.28	4.27	4.31	4.29
11	2.13	2.28	2.44	2.60	2.76	2.92	3.06	3.20	3.29	3.52	3.72	3.90	4.04	4.18	4.27	4.29	4.30	4.24	4.17
12	2.31	2.47	2.63	2.79	2.95	3.11	3.29	3.36	3.50	3.73	3.92	4.07	4.18	4.27	4.31	4.29	4.25	4.08	
13	2.47	2.64	2.81	2.98	3.14	3.30	3.43	3.56	3.70	3.92	4.08	4.20	4.29	4.30	4.24	4.19			
14	2.64	2.82	3.00	3.17	3.33	3.49	3.62	3.74	3.86	4.05	4.18	4.26	4.30	4.23	4.07				
15	2.80	2.98	3.16	3.34	3.50	3.65	3.78	3.89	4.00	4.17	4.26	4.32	4.25	4.10					
16	2.95	3.15	3.34	3.50	3.66	3.79	3.91	4.03	4.12	4.25	4.30	4.26							
17	3.10	3.30	3.47	3.63	3.79	3.91	4.03	4.15	4.24	4.28	4.28	4.17							
18	3.24	3.44	3.61	3.77	3.91	4.04	4.14	4.23	4.34	4.30	4.18								
19	3.37	3.56	3.73	3.89	4.02	4.12	4.21	4.28	4.32	4.26	4.07								
20	3.49	3.68	3.86	4.00	4.14	4.21	4.27	4.31	4.29	4.15									
21	3.61	3.78	3.95	4.10	4.23	4.27	4.29	4.30	4.26	4.08									
22	3.73	3.89	4.04	4.18	4.27	4.29	4.30	4.24	4.17										
23	3.83	4.00	4.15	4.23	4.29	4.30	4.28	4.17	4.08										
24	3.92	4.08	4.20	4.27	4.31	4.29	4.25	4.08											
25	4.00	4.15	4.25	4.29	4.29	4.26	4.23												
26	4.08	4.20	4.29	4.30	4.24	4.19													
27	4.14	4.25	4.30	4.29	4.15	4.10													
28	4.18	4.28	4.30	4.23	4.07														
29	4.24	4.30	4.29	4.15															
30	4.26	4.32	4.25	4.10															
31	4.29	4.28	4.19																
32	4.30	4.26	4.10																
33	4.29	4.22																	
34	4.28	4.17																	
35	4.22	4.05																	
36	4.18																		
37	4.13																		
38	4.07																		

The horse-power transmitted by pulp pulleys is 9 per cent. less than that given in the tables for wood pulleys.

For an arc of contact less than 180° multiply by a correction coefficient as per the following table:

Arc of contact	120°	130°	140°	150°	160°	170°	180°
Coefficient .	.76	.80	.84	.88	.93	.97	1.0